SCIENTIFIC AMERICAN

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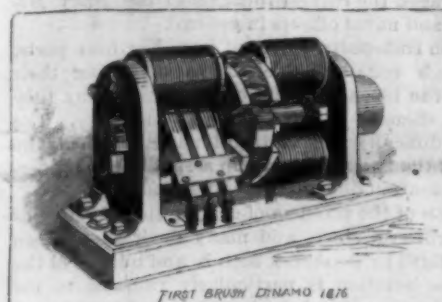

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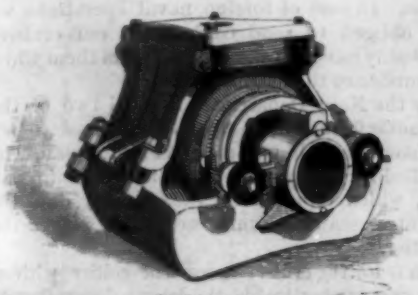

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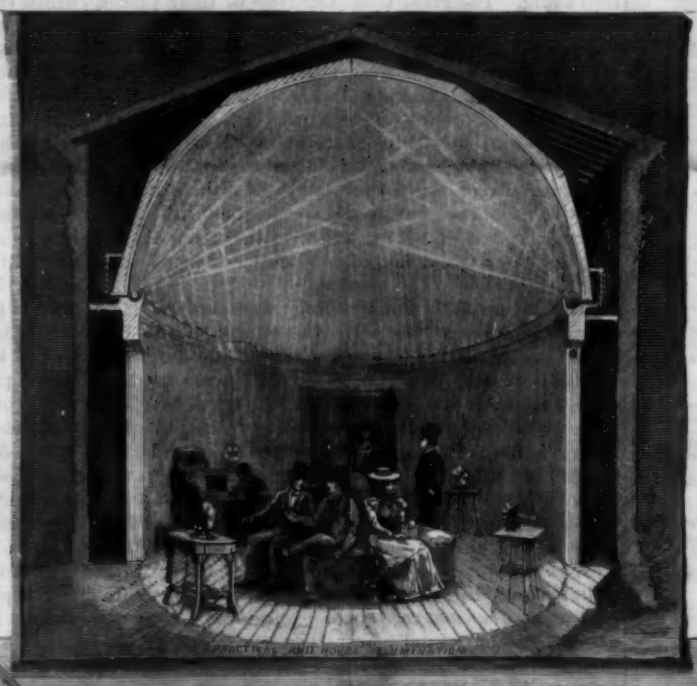

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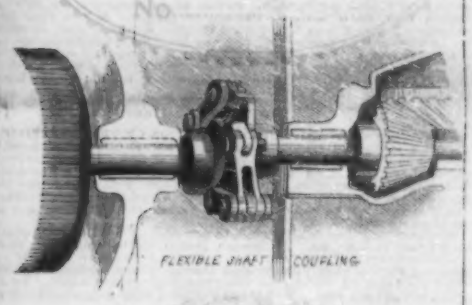

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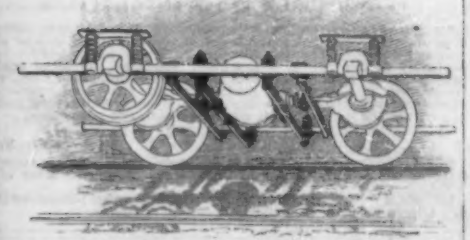

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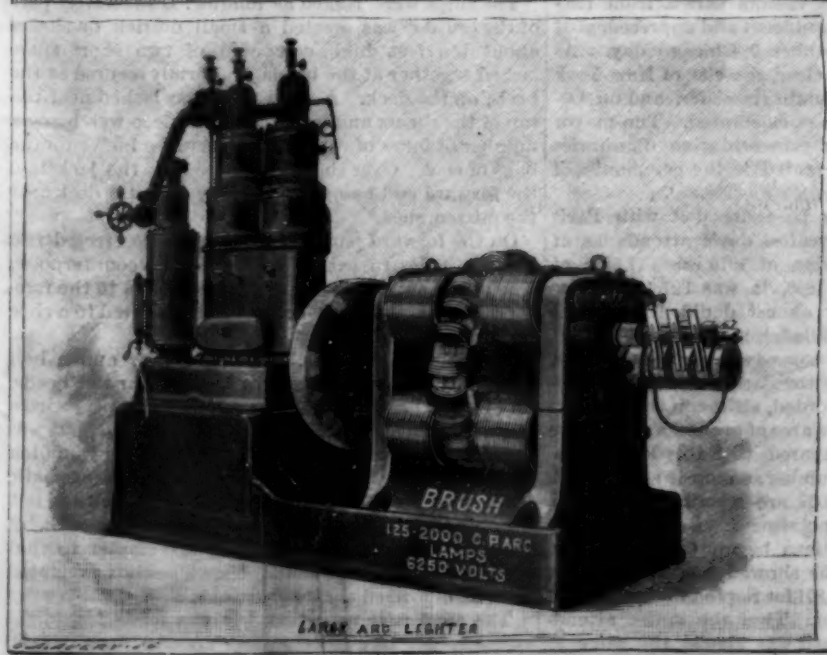

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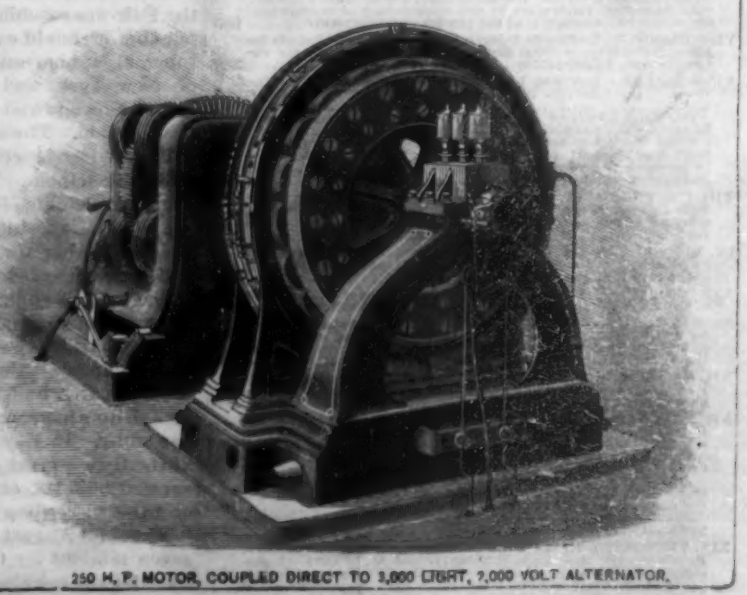

250 H. P. MOTOR, COUPLED DIRECT TO 1,000 LIGHT, 2,000 VOLT ALTERNATOR.

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE BRUSH ELECTRIC COMPANY—[See page 295.]

Scientific American.

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NEW YORK, SATURDAY, NOVEMBER 4, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 931.

For the Week Ending November 4, 1893.

Price 10 cents. For sale by all newsdealers

CLOSING OF THE WORLD'S COLUMBIAN EXPOSITION.

When our readers shall have received this paper the Chicago exhibition will be no more. After months of debate, after suggestions as to the city where it should be held, after criticisms and congratulations innumerable following the decision as to site, Chicago may justly claim to have honored herself and the United States by her achievements. In a time unprecedentedly limited when compared to the work to be done, the buildings were erected and the Fair was opened at the appointed date. From the sea of mud, as the ground was described in its early winter and spring days, the lovely Jackson Park, with its beautiful landscape and floral features and its Venice-like lagoons, blossomed into being. The great buildings rose in their places, the fountains and statuary were installed, and the White City appropriately graced its surroundings.

In many ways the Fair was an innovation. The combination of landscape and waterscape was new. The great area occupied necessitated adequate means of transportation within the grounds. The buildings, too, were so large as to make it hard to see them satisfactorily. Accordingly the waters of the lake were utilized, and the water transportation within the grounds became one of the features. Bringing old and new together, gondolas from Venice competed with electric launches in this service.

The Fair grounds and buildings were not merely a receptacle for exhibits. By the efforts of the best architects and artists of our nation the buildings and statuary became the best exhibit. Unsurpassed by man when their size is considered, the great buildings have received numerous encomiums from all critics from the art standpoint. The statuary on them and distributed through the grounds was another feature of great attractiveness. Thus having provided a true world's pleasure ground, Chicago drew upon the treasures of the globe for its adornment with exhibits. But, in the opinion of many, the work of Chicago (the grounds and buildings) surpassed their contents (the exhibits). This marked a recent innovation, for the artistic side has usually been esteemed as of secondary importance in the buildings and grounds of World's Fairs. Paris, in 1889, set an example which Chicago, in 1893, followed to its proper conclusion.

The system of concessions, as carried out upon the Midway Plaisance, introduced the spectacular element, but of a character of real value. Never before had the different nations of the world had so impressive a showing—no such practical lessons in anthropology have ever been given. The attendance at the Fair has been one of its wonders. A thousand miles from the seaboard, its situation seemed to militate against it. But thirty-seven railroads, with over seventy-six thousand miles of track, center in Chicago. Without a change of cars, almost any inhabitant of the continent could reach the Fair on some of these lines.

At World's Fairs it has become the custom to have days devoted to or in honor of special occasions, States, cities, or countries. These are signalized usually by a greater attendance than usual. At Chicago we find a record of 128,965 paid admissions on opening day, 283,273 on the Fourth of July, 160,382 on New York day and 243,951 on Illinois day. These records appear small if contrasted with the October attendance, when the daily visitors varied from 138,196 on October 2 to the magnificent and unprecedented number of 716,881 on October 9, Chicago day. As the Fair was reaching its close, the city of New York felt that it should congratulate its sister, and on October 21 Manhattan day was celebrated. The mayor of New York and other representative dignitaries visited Chicago and participated in the ceremonies of the occasion. The attendance was 298,928.

These attendances may be contrasted with Paris and Philadelphia. The greatest day's attendance at the Philadelphia Exposition of 1876 was 217,526; at the Paris Exposition of 1889, it was 397,150. Thus Chicago on her own day almost doubled the Paris and almost trebled the Philadelphia figures.

The total attendance of some twenty-one millions is, however, inferior to that of the Paris Fair of 1889, where 28,149,353 visitors were recorded, although the Chicago Fair occupied six times the area of ground and had five times the area roofed compared with this Exposition. The visitors increased in number as month after month passed by. In May 1,050,037 are recorded. This was at the time a great disappointment. But when June showed 2,673,113, expectations began to be brighter, and the succeeding months showed 2,760,263 for July, 3,515,493 for August, 4,659,871 for September, and about seven millions for October. Thus the entire attendance for the opening month was almost the same as that of two days in October—Chicago and Manhattan days. If Chicago were a little further south and if its Fair had another month of life, the attendance would probably reach thirty millions.

And now it passes into history as one of the world's wonders, as one of man's greatest achievements, something that the present generation can hardly hope to see equaled.

COALING CRUISERS AT SEA.

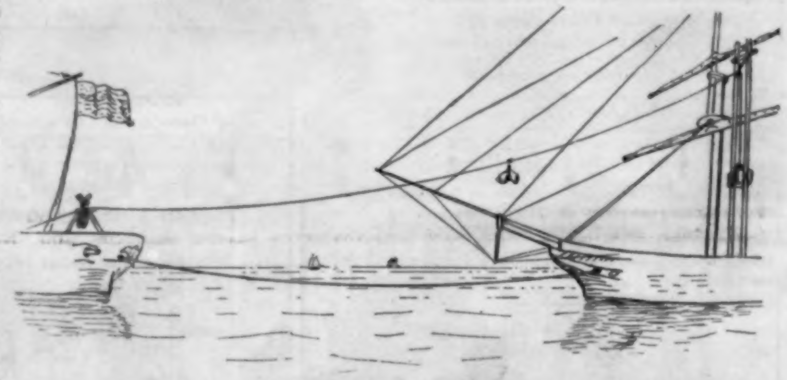
During the war of the rebellion we kept a large fleet of vessels on blockading duty. They were often obliged to keep the sea for long periods of time, especially off the Carolina coasts, and the question of methods of supplying them with provisions and coal was one which engaged the earnest thought of the Navy Department and naval officers in general.

Provision transports were sent from Northern ports, and though usually successful in delivering their freight to the blockading fleet, yet occasionally they met with disaster and frequently with delay. The principal difficulty was in transferring the coal, the motions of the two ships, even in a small sea, rendering the operation difficult and dangerous.

A solution of the problem of coaling ships at sea has been sought ever since, and many devices have been brought forth by inventors both in and outside of the navy. The solution is particularly valuable to the United States in view of the fact that we have no coaling stations. In case of foreign naval operations we would be obliged to send colliers, and our cruisers would probably have to take the coal from them while at sea or outside of the marine league.

Recently the Navy Department ordered two of the North Atlantic fleet to be equipped and rigged to try the experiment of coaling at sea after a new plan. The ships detailed for this purpose were the flagship San Francisco, which represented the cruiser, and the United States steamer Kearsarge, which played the part of collier.

The plan is for the cruiser to tow the collier with as short a hawser as practicable, the length depending on



COALING VESSELS AT SEA.

the state of the sea. The smoother the sea the shorter the tow line. In order that there shall be as little jump to the ships as possible, the cruiser steams ahead very slowly, barely having steerage way.

A jackstay is rigged between the two ships, the higher end being on the collier and the coal in bags, suspended from trolley wheels which hang on the jackstay, runs by force of gravity from the collier to the cruiser. The jackstay consists of a steel wire rope about three-quarters of one inch in diameter. It must be kept properly taut and yet must get no undue strain either from towing or from the plunging of the ships. This is accomplished by using a counterpoise.

The experiment was tried on the 18th of October, off Sandy Hook.

The ships were rigged as follows: On the after part of the cruiser was erected a small derrick or shears about ten feet high, composed of two short spars lashed together at the heads and firmly secured at the heels, on the deck. A cross piece was lashed near the top of the shears and from this cross piece was hung a number of fakes of rope cable to act as a buffer for the bags of coal. Over the cross piece ran the jackstay, the forward end being firmly fastened to the deck near the mizzen mast.

On the forward part of the collier were erected two upright poles to act as guides for the counterpoise. The upper ends of these poles were lashed to the foretopsail yard, the heels being firmly secured to a shoe on the forecastle deck.

The poles were parallel and about four and a half feet apart. A cross piece was lashed near the heads, and from a bridle from this cross piece was suspended a large iron sheave or gin block. Between the poles was arranged a cubical box with guide irons surrounding the poles. The box was also fitted with an automatic lever, spring and eccentric clutches to prevent the box dropping to the deck in case of accidental parting of the jackstay. The contrivance was similar to that used on elevators in buildings. The box weighted with sand formed the counterpoise.

The steel wire rope jackstay was made fast to the counterpoise box, then passed up and over the gin block at the head of the poles, and thence to the

cruiser over the cross piece on the shears, and the end secure on the deck, as before mentioned. Sufficient strain was put on the jackstay to hoist the counterpoise box about half way up the poles. As the ships roll and pitch, the counterpoise box slides up and down between the poles, keeping a constant and even stress on the jackstay.

Both the shears on the cruiser and the poles on the collier were firmly held in place by rope guys and stays. The coal, in sacks is hoisted by a special tackle on board the collier up to the top of the poles, where it is hooked to a small trolley wheel, which is placed on the jackstay. When released, the weight of the coal causes the trolley wheel to run down the inclined jackstay to the cruiser. Just before it arrives at the shears, a tripping device throws the trolley off the jackstay, and the sack of coal falls to the deck, its forward motion being checked by the buffer made of hawser loops.

The distance between the ships, or rather the distance from the shears on the cruiser to the upright poles on the collier, was about two hundred and thirty-five feet. The height of the gin block above the cross bar of the shears was about thirty-two feet. The inclination of the jackstay to the horizontal was about seven degrees and fifty minutes. The total weight of the counterpoise box and its load of sand was about sixteen hundred pounds. The weight of the bags of coal was nearly two hundred pounds. The time of travel from pole head to shear head was about fourteen seconds. The full time of hoisting and sending over ten bags was about twenty-one minutes. This gives a rate of delivery of about two and two-thirds tons per hour.

All parts of the apparatus worked well, but as the sea was calm, it was impossible to tell what would be the result in even a moderate sea. In a rough sea the distance between the ships would have to be increased, and there must be a corresponding increase in the height of the gin block in order that the proper inclination shall be given to the jackstay.

Although there is doubt about the apparatus working properly in a seaway, yet the most important defect is the slowness of delivering coal. On a properly and specially equipped collier, this no doubt would be bettered by the use of steam winch in hoisting the coal, instead of hoisting by hand, as was done in the experiment. There would also be used two jackstays, one on each side, running from either bow of the collier to the quarters of the cruiser.

Whether this device, with such improvements as may from time to time be suggested by experiments, is the one to be adopted for coaling at sea or not, remains to be decided by our brainy readers.

Any one who will devise a method of rapidly and safely coaling our cruisers at sea will add to the navy's efficiency and, no doubt, will receive an abundant reward in dollars from the government. BRAINARD.

Approaching Completion of the Manchester Ship Canal.

The deputy chairman of the company recently informed the Manchester Corporation that there was every probability of a waterway being opened for ships to the docks and wharves of the city on the first of January, and he quoted a letter written by the dredging master promising a minimum depth of 23 feet of water throughout the canal by that date. As an earnest of the fulfillment of this, we hear, says the *Engineer*, that a steamer reached Runcorn by the canal last week, which proves that the work of construction in the estuary is finished. This, from an engineering point of view, was the most harzardous and difficult portion. We congratulate the engineers on bringing it to a successful termination. On board the steamer were several of the directors of the Peninsular and Oriental Steamship Company, but with what object they paid the visit has not transpired. Manchester goods form a considerable portion of the tonnage carried through the Suez Canal, and at a public meeting in Manchester eight years ago, Monsieur De Lesseps told his audience that in his opinion the Suez Canal ended in Manchester. No doubt a direct trade will be done between Manchester and Bombay, and it is probable that the Peninsular and Oriental line will be early in the field. It is not six years since the first sod was cut at Eastham. The amount of work accomplished since then is astonishing; and when we consider the opposition that has been encountered from such powerful bodies as the Mersey Dock and Harbor Board and the railway companies as well as the elements, it is surprising to find the canal is so nearly finished. The weather has favored the contractors of late, as it did at the commencement of the work.

THE depth to which the sun's rays penetrate water has been recently determined by the aid of photography. It has been found that a depth of 553 feet the darkness was to all intents and purposes the same as that on a clear but moonless night. Sensitized plates exposed at this depth for a considerable length of time gave no evidence of light action.

Russian Exhibits.—Russia's projected government house was never completed, but her pavilion in the Manufactures building is so spacious that it serves the purpose in considerable measure.

One corner of this pavilion, which fronts upon the main avenue of the building, is in the form of a Russian church with green roof, bulb shaped tower, colored windows and religious pictures. At each side of the broad entrance to the pavilion, and in its center, stands a massive rhodonite vase. They are so tall as to be suitable ornaments in this largest of buildings, and are as beautiful in form as they are rich in color.

When, at last, one turns away from these, it is to notice on the right a curious and beautiful piece of furniture, a bookcase and cabinet combined, decorated with burnt work by Madame Semetchine, of St. Petersburg. The doors and panels are ornamented with portraits of Tolstoi and scenes from his life. The portraits represent him at different ages; the other pictures show him plowing in a field, writing in a plain room, and engaged in other avocations. The delicacy and finish of this burnt work is not excelled by that produced by a brush. One cannot but admire a woman bright enough to give us Americans an epitome of the life of her one countryman, whose name is somewhat familiar even among the masses of our people, and in a form to attract universal attention.

Close at hand are the bronzes shown by the St. Petersburg firm of Stange. They are made from models left by the great sculptor Eugenius Lanceray, a Russian of French extraction, who died in 1885, at the age of thirty-seven. Of art training he had only what an amateur can get in the studios and galleries of Paris; but wandering in the Caucasus and the Crimea, and along the steppes inhabited by the Bashkirs and Kirghizes, he studied national life until he could represent it in enduring form.

Horsemen and horses are his subjects, and the figures are small—about the size of Barye's. They are all full of action; none is more spirited than that of Sviastoslaw. His head is bare, he sits his horse as if forgetful of it, and with sword in hand is arranging his troops; his expression is so animated that one almost sees the men falling into position before that commanding presence.

Among the most striking groups is that called "After the Battle;" his last and largest group, composed of graceful, dashing horses, is named "An Arab Fantasie." Many of these bronzes have been sold; the remaining ones are to be brought to New York when the Fair closes.

Near by there are many other little bronzes by other sculptors, whose names I could not learn. They are charming pictures of peasant life, but none are so fine as Lanceray's. The Russians show wonderful aptitude for this miniature work. Further evidence is given in a case which one might easily pass unnoticed, and yet which is full of interest. It contains quaint little figures, six or eight inches high, in the various occupations and positions which peasant every-day life affords; they are dressed in costumes barbaric in color and clumsy in form, but every pose is perfectly natural. The little people are made of *bread* by a lady in St. Petersburg. The notice under them is one of the numerous examples of curious English which one sees. Here it is: "I beg to considerer for my articles only those that have my initiales on the backside."

Close to the Lanceray bronzes is a large case containing very heavy fabrics, rich in texture and color, made in Moscow from silk cocoons grown in Southern Russia. The silk is wound on an Atwood machine made in Stonington, Ct.

For specimens of painstaking, patient work, nothing in the department equals the three "imperial appanages." They would be called cabinets in our language. They are made of highly finished light wood, have gilt decoration and marble tops, but their chief beauty is in the doors, which make the entire front of the upper part of the cabinet. These doors are mosaics of bits of marble almost microscopic in size and so perfectly matched that only the closest scrutiny shows how they are made. Italian mosaics which I have seen are coarse in comparison. One pair of doors represents a scene which might have been taken from an Amazon forest, as very likely it was. There is a mass of tropical plants, with birds and monkeys among them; the effect of a soft, hazy atmosphere is perfect; the touches of brilliant color in a bird's wing or a stray leaf add to the delightful picture. The base of this cabinet, as well as the ornamentation below the door, are also of mosaic, and upon the whole 14,558 days' work was spent. The mosaics of the other two "appanages" are very rich in color, but have a less elaborate design; they are simply birds of beautiful plumage upon a background of lapis-lazuli from the stone works at Petershof.

Close at hand are bowls cut from jades of a light shade, wonderful for size and finish. A very rich labradorite table and pedestals must be most tempting to people who can surround themselves with objects of enduring beauty. They are less showy than the superb malachite and gold tables which stand near them.

A significant gift shown among the work of the silversmiths is a magnificent dish in silver and gold given by the Cossacks of the Urals to the Czarewich. The perfection of workmanship which is attainable in the handling of these metals is shown in a gold salver with a silver napkin lying upon it, so exact an imitation of linen that one can hardly believe it to be an imitation.

The exhibit of the Imperial State Paper Manufactory is worth careful examination. It is the outgrowth of the use of paper money in the empire, begun about a century ago. The first bank notes were made in a little mill near St. Petersburg; but in 1818 the institution which has since grown to great proportions was founded. Its product is now taken both by the government and private concerns. In 1860 new buildings were finished and equipped with English machinery for the manufacture of paper, and with German printing presses, the buildings and plant costing two and a half million dollars.

The Minister of Finance appoints the director, who is at the head of the business, and the number of officials under him is regulated by law. The proceeds of the business, after expenses are paid, are divided equally between the government treasury and the employes. The manufactory also furnishes for their employes and their families 373 dwellings, a dining hall for 350, an elementary school, a chapel, a hospital with 30 beds, and physicians and attendants. The great establishment is on Fontanka Quay in St. Petersburg.

The pavilion in which its exhibit is placed is of Circassian nutwood, ornamented with panels of polished platano. This, as well as all the frames and showcases, were designed and made in the cabinet making department of the manufactory. The paper is made entirely of hemp and rags, hemp being the chief constituent of that used for bank notes. Specimens of the products shown are water-marked, hand-made, and machine-made in sheets, and the continuous web made by machine. The bank note paper has a silk net in the middle of the sheet, which is put into the pulp, and twenty-five looms are in use weaving this net.

The printing done in the establishment is illustrated in the form of these bank notes, postage and other stamps, bonds, drafts, etc. By means of a machine invented in 1891 by Mr. Orloff, an engineer in the works, colored figure printing from *cliches in relievo* is done. "This system of figured printing renders it possible to obtain various patterns and designs in many colors, gradually passing from one tint to another, from one stereotype and at one impression." (Statement made in pamphlet about the works, found in the exhibit.) The establishment makes all its own type and in the last two years has replaced much of the old by type made from original designs.

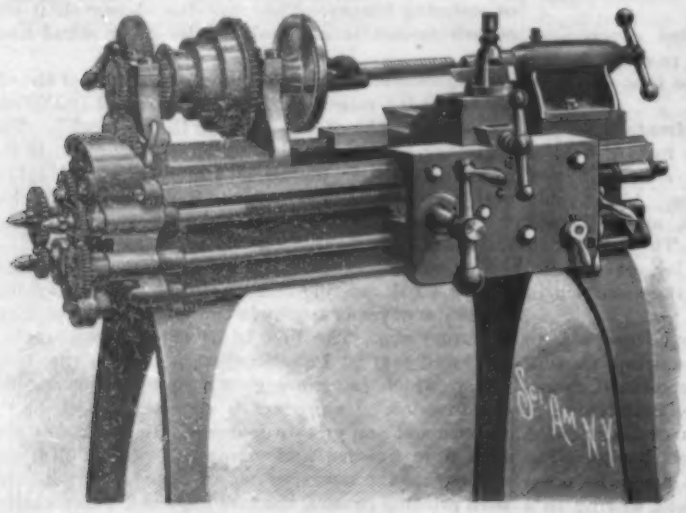
The display of copper and iron electrotypes includes a wide range of subjects; among them are Alexander the Great, a bass-relief from a marble in the Imperial Hermitage; Copernicus, a bass-relief in wax by Krynsky; shields, helmets, swords, and daggers of ancient and sometimes unknown origin, but elaborate in design; heads of Michel Angelo, Catherine II, M. Jacobi, the inventor of the electrotype process, and many others. The bust of J. N. Niepce and that of the Empress Marie Feodorovna are iron electrotypes without seams. The different photo-mechanical processes, heliogravure, photo-zincography, photo-relief, photo-lithography, and collotype are all illustrated by most interesting examples. The helio-engravings, nine in number, from originals by Chemezoff, Soutman, Vyscher and five other artists, executed by a special process discovered in the manufactory, are in the most prominent place on one of the sides of the pavilion. They are remarkable for their clearness and beauty.

In no section of the Fair did I see so much to indicate that large sales were being made as in the fur room of the Russian pavilion. The assortment was extensive: mink, sable, seal, and the less costly skins were all displayed to fine advantage, and women in stylish toilets found them fascinating when the mercury hovered among the nineties. They had the same air of business as had the lady who was inquiring the prices of the engravings in the Art Gallery and selecting certain ones because "they furnish more than large pictures."

(To be continued.)

AN IMPROVED SCREW-CUTTING LATHE.

This lathe permits the operator to easily and quickly bring the cutting tool back to the exact position on the beginning of the cut, so that a perfect and uniform thread is quickly made and no time is lost in finding the beginning of the cut, as is the case with screw-cutting lathes of the ordinary construction. The improvement has been patented by Mr. James H. Paterson, Box 430, Ingersoll, Ontario, Canada. The lathe has the usual bed supporting on one end the head stock with spindle engaging the work, held



PATERSON'S SCREW-CUTTING LATHE.

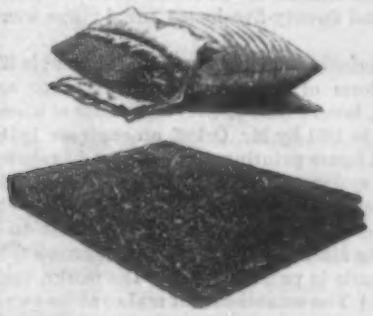
at its other end in the mandrel of the tail stock, the cutting tool being mounted in the usual tool holder, transversely adjustable on the carriage sliding in bearings on the bed. Through the front of the carriage passes the feed shaft, journaled in bearings at the ends of the bed, and this shaft is engaged by a half nut sliding in bearings on the inside of the carriage by moving the handle, A, to a vertical position, the carriage being disengaged from the feed shaft when this handle is in a horizontal position. When the half nut is out of engagement with the feed shaft the carriage may be moved backward or forward by turning the handle, C, on a transverse shaft carrying a pinion meshing with a gear wheel on a short shaft turning in bearings in the carriage. The latter shaft has a gear wheel meshing with a rack on the bed, and is also adapted to be connected with a longitudinal auxiliary shaft journaled below the feed shaft, and forming the principal part of an intermediate mechanism for controlling the speed of the feed shaft, to permit of cutting any desired number of threads to the inch on the work, the number not necessarily being a multiple of the number of threads per inch of the feed shaft. This auxiliary shaft is thrown into and out of connection with the carriage by means of a bevel gear and pinion connection actuated by the handle, B. Connecting the auxiliary shaft with the feed shaft is an adjustable gear and clutch mechanism, and the arrangement is such that no backing belt or other means are necessary to catch the thread on the work, whether the thread to be cut is or is not a multiple of the number of threads per inch on the feed shaft.

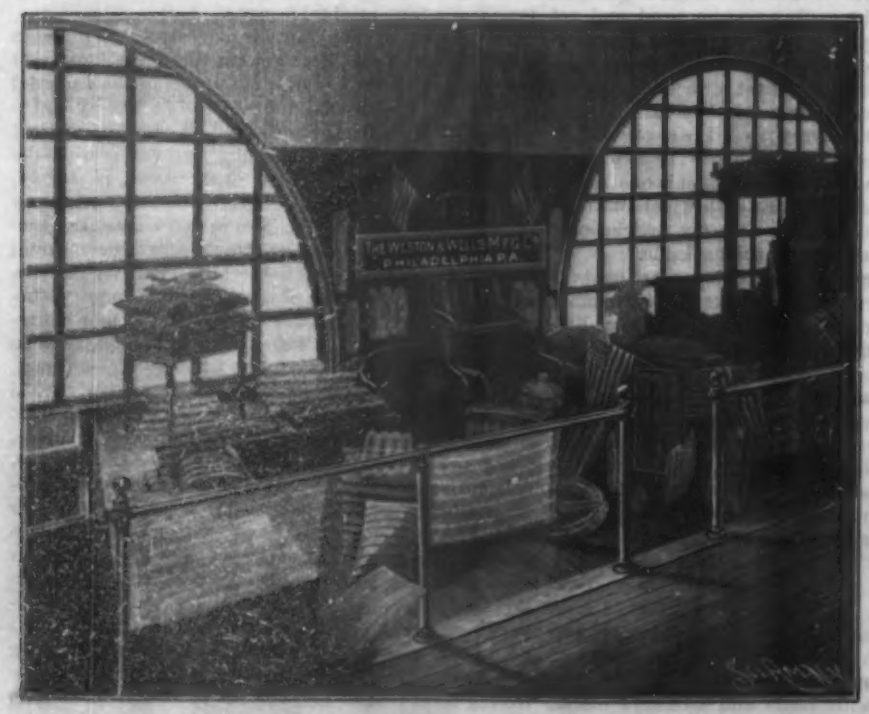
Vanillin from Cloves.

Professor Jorissen and E. Hairs, noting the similarity in composition between vanillin and eugenol, have examined cloves and the essential oil obtained from them to ascertain whether vanillin was one of their constituents. An ethereal tincture of cloves was prepared and treated with solution of sodium acid sulphite. This solution, being separated, was then treated with a mineral acid and the sulphurous acid thus liberated removed, after which the mixture was agitated with ether. This, on being separated and evaporated, left a residue which gave off a strong odor of vanilla. A similar, crystalline residue was obtained on subjecting oil of cloves to the same treatment. The crystals were soluble in water, especially when warm, also in alcohol and ether. They were colored by ferric chloride, began to melt at 79°, and sublimed readily. The yield was very small, so that an extended examination was not possible, but the investigators consider that the physical and chemical characters of the product, so far as they have been ascertained, indicate its identity with vanillin.—*Bull. de Pharm.*

TORSION BRAIDED WIRE MATTRESSES, PILLOWS, CUSHIONS, ETC., SHOWN AT THE EXPOSITION.

The articles shown in this exhibit presented a degree of novelty and utility that caused them to attract much attention, and to receive the highest award. They are the product of a comparatively new manufacture, originating in the invention, in 1882, by Dr. Henry Weston, of Philadelphia, of the cylindrical braided wire pillow. The successful application of the principle was not attained without further costly experiment, and the invention, by Mr. Joseph L. Wells, of the braided wire torsion spring, by which perfect resiliency is obtained, and whereby pressure on any part and to any degree causes the wire to twist instead of bending or breaking. Mattresses, pillows, cushions, etc., made according to this improvement, afford a gentle, softly yielding support, but they do not become heated, as is the case when they are filled with feathers, hair, moss, or other material, for each slight movement changes the air beneath, and they do not absorb odors, become musty, or retain perspiration or disease germs. The mattresses and pillows are covered with a light covering of fine curled hair or other material, which may be removed for cleaning when necessary; but there is little to attract bugs, moths, or other insects. The wire is heavily tinned to resist rust, and the articles are all well made of so excellent a quality of steel wire as to be practically indestructible. The best known doctors and surgeons in the country have written very strong testimonials as to the superiority of these goods for hospital service, and for general use their adaptation is equally obvious. In warm weather, especially, they constitute a positive luxury. These goods are made only by the Weston & Wells Manufacturing Company, 1110-1116 Noble Street, Philadelphia, Pa.



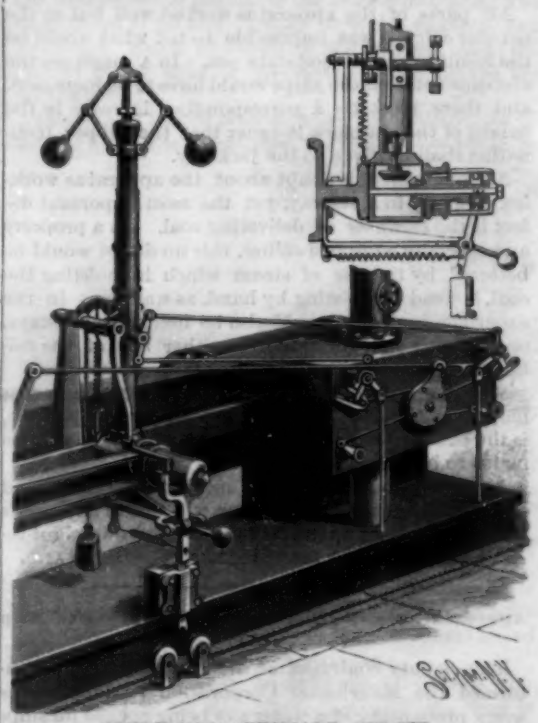


THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE WESTON & WELLS MANUFACTURING COMPANY, OF PHILADELPHIA PA.

ASPHALT pavements were first laid in Paris in 1854.

AN AUXILIARY CUT-OFF FOR ENGINES.

This is an improvement capable of attachment to any engine, whereby the engine may be stopped in a moment from any point in the building. It has been patented by Mr. John H. Tennyson, of No. 54 Charlton Street, New York City. The small figure represents a longitudinal section through the governor driving gear, illustrating a shifting form of gear, and the gear, practically in two sections, in its shifted position. A beveled gear at the lower end of the governor stem constitutes one section, and another beveled gear on a hub sliding on a guide rod in a casing forms the other section, there being on the hub a clutch sleeve with trunnions passing through blocks sliding in the arms of a fork, whose shank, at its lower end, is adapted to engage with a bolt. When the stem of the fork is in engagement with the bolt the governor gears will be in mesh, which is their normal position. A spiral spring tends to draw the shank of the fork out of engagement with the bolt, and, to accelerate the movement of the fork when released from the bolt, a weight is also attached to the front portion of the shank near its lower end. At the rear of the governor casing is a standard in which is journaled a rock shaft with a rigidly attached curved trip arm, from which are suspended weights capable of drawing the arm downward and rocking the shaft. The arm has at one side a friction roller adapted to contact with the governor crank, carrying the shifting rod connected with the governor sleeve to draw downward the governor pawls. The governor crank also carries the usual rocking bar, to the opposite ends of which the ordinary cut-off rods are pivotally connected. The cut-off valve has stops, and when



TENNYSON'S AUXILIARY CUT-OFF.

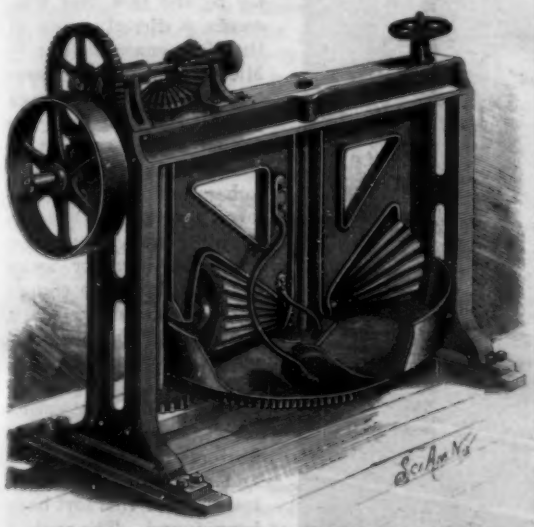
the cut-off rods are shifted by the trip mechanism one of the stops will engage with a crab to prevent the pick from touching the valve fingers, insuring a positive and permanent cut-off. To make the forward movement of the trip arm as rapid as possible, such movement is aided by one or more springs. A lock arm extending downward from the rock shaft has at its lower end a friction roller resting on a lock bar secured to the upper end of one member of the fork connected with the shifting governor gear, normally holding the rock shaft in such position as to prevent the trip arm from engaging with the governor crank. The bolt which engages the shank of the fork is connected by chains or cables with any desired part of the building, and by withdrawing the bolt the two sections of the driving governor gear are separated, thus silencing the governor. At the same instant the lock bar is withdrawn from under the lock arm and the weights and springs draw downward the trip arm, engaging the governor crank and causing the governor balls to be closed, the crank also shifting the rocking bar of the cut-off rods to cause the valves to cut off. The device may be applied to any cut-off engine or any ball governor.

Curious Origin of a Fire.

The other day a heavy delivery wagon backed up in front of an Eighth Avenue furniture store. The smoothness and slant of the asphalt gave greater momentum than was expected, and the hind wheels struck the curb with a crash. The contact of stone and iron drew out sparks. Some of these flew into a wisp of packing hay that soon gave forth smoke and flame. A bucket of water subdued the blaze, but, as a fireman remarked, it was an interesting object lesson on one of the mysterious ways in which serious fires sometimes start.—*N. Y. Sun.*

A KNEADING OR MIXING MACHINE.

This machine is adapted for kneading or mixing paste of any description, especially such as is used in making macaroni. The machine was awarded a medal at the Columbian Exposition, and each machine makes between 3,500 and 4,000 pounds a day. The improvement has been patented by Mr. Auguste Witz, No. 138 James Street, New York City. Mixing rolls, which may be of the usual construction, are journaled in hangers forming part of a suitable frame, and the mixing pan is connected with a central shaft journaled in upper and lower cross beams of the frame. The lower cross beam is adjustable as to height by means of an adjusting shaft, whose lower end is threaded, the upper end having a hand wheel. Around the pan at the bottom are teeth adapted to engage a gear on the lower end of a vertical shaft, to be driven according to any of the usual methods of applying power. The shovels in the bottom of the pan, which constitute the principal feature of the invention, are of sheet metal, bent upon itself to a substantially U-shape in cross section, the upper member considerably overhanging the lower member. The shovels are placed on opposite sides of the central shaft, their contracted portions facing in opposite directions, and one shovel is located near the center of the pan while the other is near its periphery. The shovels are held stationary within the pan by a shank secured to the hangers, and the reduced end of the shovel near the periphery of the pan may be brought practically in engagement therewith, while the pointed end of the opposite shovel is located a predetermined distance from the center of the pan. As the pan is revolved, the outer shovel curves the outer edge of the paste upward and toward the center of the pan, the inner shovel also curving the inner edge of the paste over on the mass, which is thus presented to the rolls in



WITZ'S KNEADING OR MIXING MACHINE.

such manner that all the particles will be thoroughly and effectively operated upon. A diagonally placed central shovel returns to the mass any fragments which may be thrown into the middle of the pan.

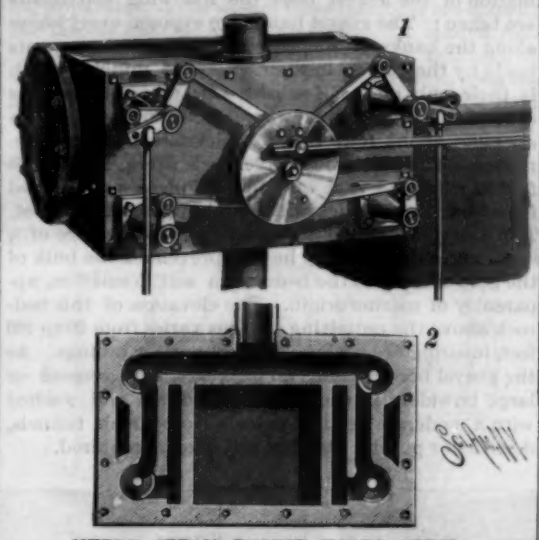
A CHEAP AND NOVEL ROAD BED.

An invention designed to facilitate the construction of improved roads and highways is shown in the accompanying illustration, and has been patented by Mr. John Platten, of Fort Howard, Wis. The roadbed is made with a crib formed of transverse parallel planking, on top of which are secured parallel longitudinal stringers, a filling of loose earth, gravel or broken stone being compacted between the planking and the stringers to form the road proper and completely conceal the crib, the latter protecting the road material from lateral displacement. A greater or less number of stringers may be used, as desired, and the timbers and planks may be treated, if preferred, with any cheap preservative from decay. The impact of travel on such a road is designed to thoroughly pack the ballast material about the crib frame and render the road solid and durable.

PLATTEN'S UNDERGROUND TIMBER ROAD.

AN IMPROVED STEAM ENGINE VALVE CHEST.

This valve chest is adapted for convenient application upon the valve seat of a slide valve steam engine, to convert it into one on which multiple rocker valves



MYERS' STEAM ENGINE VALVE CHEST.

and their actuating gear can be used. The improvement has been patented by Mr. William H. Myers, of No. 103 Freeman Street, Brooklyn, N. Y., and has been for some time in practical and highly satisfactory use. Fig. 1 shows the application of the improvement, with the rocker valve actuating gear, Fig. 2 being a sectional side view of the valve chest and valves. Extending along one face of the cylinder is the elongated valve seat, with the usual live steam and exhaust ports in its face, the ports being duplicated, so that there will be a pair near each end of the cylinder. The valve chest is adapted to fit upon the valve seat and conform at its outer edge with the margin of the latter, the face of the chest having contact with the seat being made true and steam tight, and the chest being secured upon the cylinder by studs or bolts. There are two transverse steam passages near each end of the chest, the outer one of each conforming with the live steam port and the inner one with the adjacent exhaust port, a rectangular central cavity and a smaller cavity near each end rendering the valve chest light and yet sufficiently strong. Near each of the four corners of the chest are transverse cylindrical steam chambers for the reception and proper action of the rocking valves, the pair of chambers at the top receiving live steam alternately from the live steam duct in the wall of the chest, and the steam passage at each end of the chest extending to one of the lower transverse chambers, which are designed to relieve the cylinder of exhaust steam by the proper action of the valve. The lower transverse chambers are intersected by branches from the exhaust steam passages, and a rocking movement of the valve permits the escape of steam into the exhaust duct. The rocking valves are set as shown in Fig. 2, one live steam port in an upper chamber being open when the one at the other end of the cylinder is closed, and in the lower chambers the valve directly beneath the opened valve is closed, while that beneath the closed valve is open. The rocker valves are actuated by a gear of well known construction, comprising a rotatably supported crank disk rocked a proper degree by an eccentric rod, from an eccentric disk on the main shaft. Downwardly extending rods enter dash pots (not shown) and crank arms connect each live steam valve with a governor, completing the rocker valve gear.

To Soften and Whiten the Hands.

Borate of soda	ʒ ij.
Glycerine	ʒ iv.
Lanolin	ʒ j.
Eucalyptol	ʒ j.
Ess. of bitter almonds	m xx.

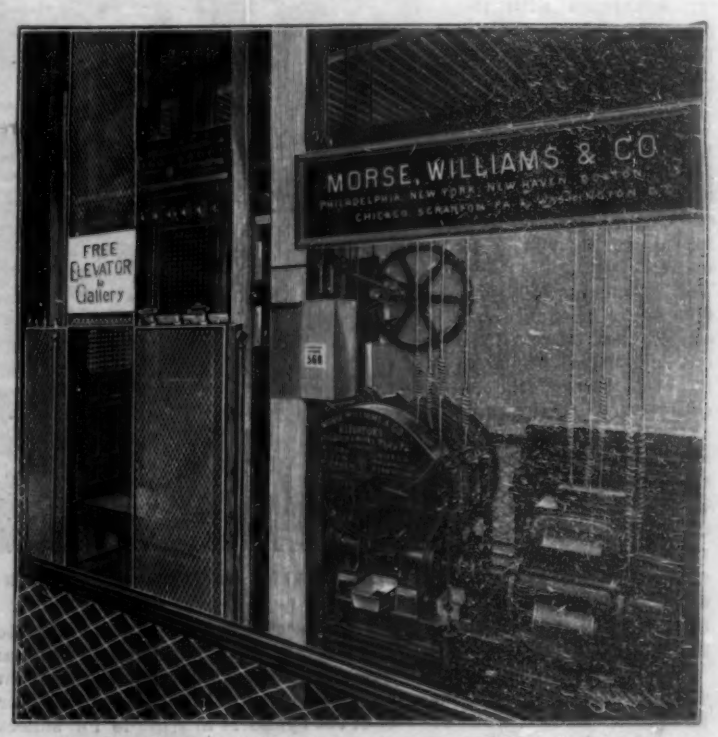
Apply at night, and afterward dust the hands with Indian chestnut flour, and cover with gloves.—*Med. Press.*

Early Chemistry.

Long before chemistry became a science many of its processes and apparatus were in common use. Professor H. Carrington Bolton has made a list of some of these, finding that the Egyptians were acquainted with the process of glass making at least as far back as 3500 B. C.; that crucibles of the 15th century B. C. are now in the Berlin Museum; and that siphons also were used in the 15th century B. C. Blowpipes and bellows were early employed. The earliest chemical laboratories now known were those of the Egyptian temples, in which the priests prepared the incense, oils, etc., used in the temple services. The Bible contains frequent chemical allusions. Cupellation is plainly described by Jeremiah, metallurgical operations by Job, Ezekiel, and others, and bellows by Jeremiah. Geber, the Arabian physician of the eighth century, wrote minutely of chemical processes. He described solution, filtration, crystallization, fusion, sublimation, distillation, cupellation, and various kinds of furnaces and apparatus. Perhaps the earliest drawings of strictly chemical apparatus are the figures of distilling apparatus in a Greek papyrus of the 11th century. An alchemist's laboratory of the 6th or 7th century was uncovered in Egypt in 1885, and its contents included a bronze furnace, about fifty bronze vases with beaks, and some conical vessels resembling sand baths. The balance as an instrument of precision reached a high development under the Arabians as early as the 12th century, when very accurate specific gravity determinations were described.—*Ceylon Advt.*

AN ELECTRIC PASSENGER ELEVATOR AT THE EXPOSITION.

An exhibit which won a medal for its superior merits and in a notable degree was made to serve the public convenience, while at the same time illustrating one of the most recent and valuable applications of electricity, is shown in accompanying illustration, and was made by Messrs. Morse, Williams & Co., of Philadelphia. The exhibit was well planned and located to permit the inspection of parts to a sufficient degree to afford an understanding of the working of this very simple and efficient passenger elevator, in which is employed the improved Hindley worm gearing, which has been made a specialty by this firm for



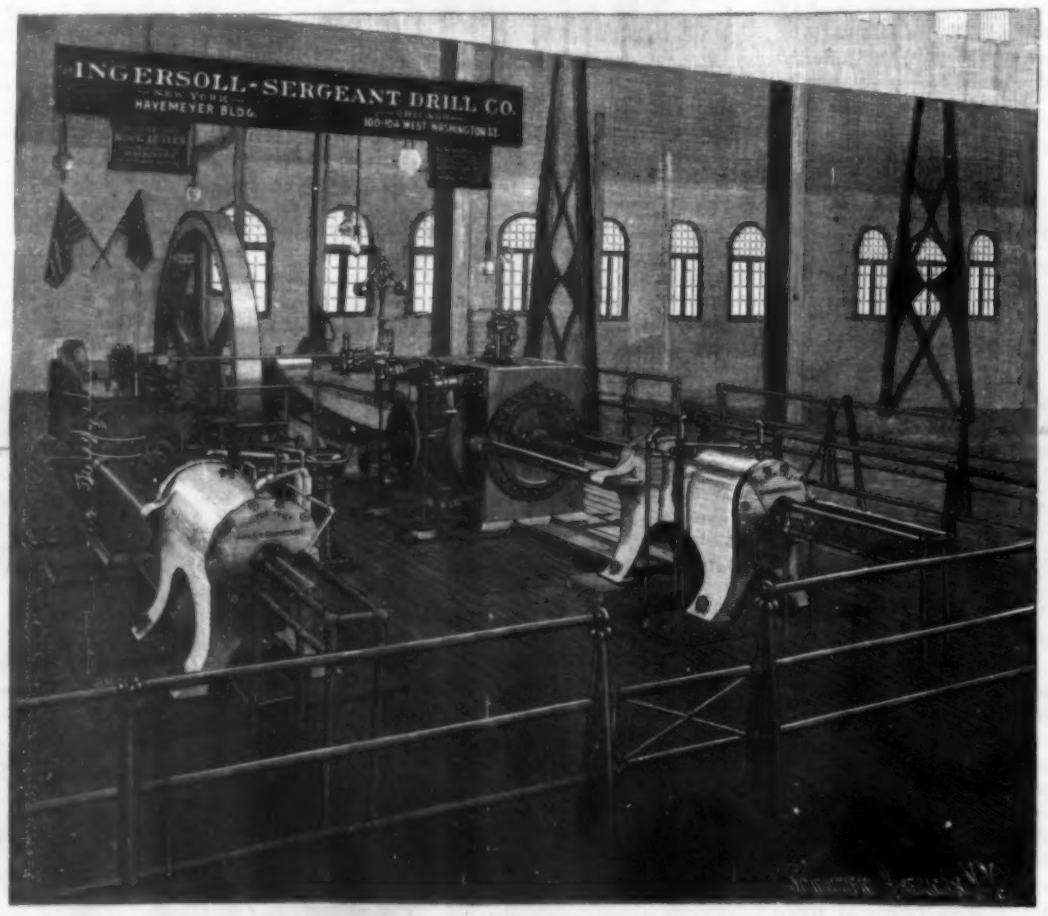
THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF MORSE, WILLIAMS & CO.

years. The motor is attached to the worm shaft by means of a coupling, the shaft being provided with a powerful double shoe brake, which is released by the action of an electro-magnet and applied by a weight; so that in case the electric current should be accidentally cut off, the brake could be instantly applied to stop the machine. The brake also acts as a governor to check the descent of the car, should it attain too great a speed. The motor is of the low speed, multipolar type, with self-oiling bearings and carbon brushes, requiring a minimum of attention. The reversing switches and controlling apparatus are of simple and improved forms, their action causing the elevator to start easily and gently with and without a load. The makers claim that the average of current used, both in raising the load and lowering the empty car, is less than in any direct electric elevator in the market. The machines are designed to raise average loads at speeds as high as 250 feet a minute. Besides these electric elevators, the firm are also manufacturers and builders of hydraulic, steam, belt, and hand power passenger and freight elevators, as well as hoisting machinery, dumb waiters, automatic hatch doors, etc.

A GREAT AIR COMPRESSOR AT THE FAIR.

Our illustration represents a plant employed by the World's Fair Commissioners to supply compressed air to exhibitors requiring air power. It is itself an exhibit by the Ingersoll-Sergeant Drill Company, of New York, and was continuously in operation throughout the Fair, furnishing compressed air to the Baldwin Locomotive Works, the Westinghouse Air Brake Companies, and others who exhibited their locomotives, air brakes, and other machinery in full operation by means of compressed air. This compressor is the crowning work of many years' experience of the company in this line, and embodies a great many improved features, the excellence of which has been attested in their widely extended practice. The plant consists of a cross compound Corliss condensing engine, cylinders 18 and 34 inches, having a stroke of 42 inches. The two air cylinders are each 18¼ inch bore and 42 inch stroke, driven direct from the piston rods of the engine. The free air, before admission to the cylinder, is taken from the point most favorable as to dryness, freedom from dust, lowness of temperature, etc., and is admitted to the air cylinder through a tube which also acts as a piston guide rod. The air inlet valves are large wrought iron rings, which open and close by the momentum caused by the movement of the piston, giving a large area of inlet with but a small throw of the valve, and reducing clearance loss to a minimum.

The cooling is effected by a new form of water jacket, the construction of the air cylinders admitting a complete jacketing of the heads and discharge valves, thus presenting a large cooling surface to the compressor at the end of each stroke where the air is hottest. By means of a new unloading device a uniform pressure is maintained in the receiver, and a uniform speed of the engine, by connections with a discharge valve on each end of the air cylinder, a weighted safety valve being connected with the receiver. When the air pressure gets above the desired point the valve lifts and the air is exhausted from behind the discharge valves, thus letting the compressed air at full receiver pressure into the cylinders at both ends and preventing the air cylinders from doing any work. The pistons in the cylinders move in equilibrium as the air passes from one end of the cylinder to the other through the discharge valves, the governor keeping the speed uniform, and there being no surplus air blown off from the receiver. A slight reduction of pressure in the receiver releases the discharge valves, when the air rushes in, the governor puts on more steam, and the work of compressing air goes on.



THE WORLD'S COLUMBIAN EXPOSITION—THE INGERSOLL-SERGEANT DRILL CO.'S AIR COMPRESSOR.

In the designing of these compressors and engines excellent taste has been shown, and all steam pipes are put below the floor, while the feet of the cylinders are covered, giving the whole plant a neat and uniform appearance. The ends of the cylinders, cylinder heads and steam chests, with all the turned parts about the valve motion and connecting rod, are beautifully polished.

This compressor has received the award from the World's Fair judges, and has been sold to a foreign gold mining company, to be exported as soon as the Exposition closes.

The Great Playa de Oro Placer Fields.

It is altogether probable, says the *Mining and Scientific Press*, that the coming year will witness the consummation of a placer mining project in South America by American capitalists that fairly rivals the largest schemes ever projected by California hydraulic miners, and that in its ultimate fruition is expected to exceed in dimensions and results the largest single similar enterprise undertaken anywhere in the world. The Playa do Oro placer fields in Ecuador are believed to be the richest and most extensive new properties yet discovered, and the work of development has been undertaken by an investment and in a manner that indicates both the good faith of the owners and their thorough conviction of the value of the placers.

The Playa de Oro property is about 11 miles distant from the town of Concepcion, as the river flows, and is on the Santiago River, a large and rapid stream flowing through the estate in a westerly direction to the Pacific. It is from 500 to 800 feet above sea level. The property forms a parallelogram, comprises 20,000 acres, and is joined by the Uimba estate on the north and the Cayapas River on the south. Gold-bearing beds cover the whole extent of the property, but only the gravel banks of a thickness of from 30 to 80 feet it is proposed to work. From the separate reports of the several engineers who have made personal survey and examination of the gravel beds, the following statements are taken: The gravel banks are exposed everywhere along the banks of the river; in the numerous cuts made by the natives in their efforts at mining, which is their only means of subsistence; along the gulches (quebradas); and everywhere that the soil, which averages about four feet in thickness, has been removed. The auriferous gravel beds average about 50 feet in thickness and only in one place was the bed found but 15 feet thick, while in many places it is 80 feet. The gravel is auriferous throughout, the presence of a small percentage of clay having prevented the bulk of the gold sinking to the bedrock, a soft formation, apparently of marine origin. The elevation of this bedrock above the outletting streams varies from 20 to 100 feet, insuring everywhere ample dump for tailings. As the gravel here contains no pipe clay, hard cement or large bowlders, it can be broken down and washed with a moderate head of water. No bedrock tunnels, derricks or powder blasting will here be required.

A cut in the Medio Mundo bank, near the town of Playa de Oro, has been worked back some 300 yards from the river through gravel 45 feet thick, exposing the bedrock for that distance. It shows a good grade for sluices and dumps, its elevation being 50 feet above bedrock, and washed by natives in their crude way yielded 97½ cents gold. Other washings of single cubic yards yielded various amounts. But the most satisfactory test has been made within the past six weeks under direction of Engineer Lord. Eighteen cubic yards were measured, worked and washed through sluices in exactly the same manner as it is proposed to develop the placers. The yield was 38 cents per cubic yard.

Rains in Ecuador are constant, and the water supply is enormous. At the town of Playa de Oro the Santiago River (500 feet wide) averages 300,000 miners' inches of water of 2,160 cubic feet each in 24 hours, or 7,500 cubic feet per second. The water for the mines will be taken from a branch of the Santiago (Rio Francklyn) at a sufficient elevation to give a large head. The river at the point where the initial canal will be built is 330 feet above bedrock at the placers.

The extent of the gravel beds is prodigious. The property covers about 60 square miles, and it is roughly estimated that there are about 1,600,000,000 cubic yards of gravel between bedrock and the grass roots. If there is an average gold value of 38 cents per cubic yard, the value of the deposit is $600,000,000! It is thought that several million dollars per year can be secured if the banks are worked at the capacity of the hydraulic appliances proposed to be put in. These figures stagger belief, but they seem to be justified. It is estimated that gold can be secured at an average of three cents per cubic yard. There will be no trouble about the disposal of the debris. There are on the ground, or purchased and about to be shipped, six miles of iron piping and four giants. One of these latter is 9 inch, which indicates pretty clearly that the company propose to wash out a great deal of gravel.

The Use of Copper Among the American Indians.

An article by R. L. Packard in the *American Antiquarian* says that careful investigation seems to show that at the time of the discovery of America copper was used by the North American Indians only as a precious metal and for ornamental purposes, and had not reached the stage of industrial use, as it had among the Aztecs in Mexico. There is, moreover, no evidence to show that the northern Indians had any knowledge of ore working or smelting, and it is almost certain that all the copper they possessed was found in the metallic or native state. There is nothing to show that they were aware of the existence of copper ore as a source of metal. No remains of smelting places, or slag, or other indications of metallurgical operations have yet been found. The quantity of copper which the Indians possessed at the time of the discovery, although the metal was diffused over a very wide territory, was very small as compared with stone. This is shown by the relatively small proportion of copper implements in the principal collections, as at the Smithsonian Institution and others. The larger numbers are found in Wisconsin, and this is accounted for by the fact that Wisconsin is directly south of the Keweenaw district in Michigan, where the largest beds of native copper occur. In these beds the copper shows as such in the rock, and the ancient miners had only to follow down a promising outcrop showing metal for a few feet, and hammer away the rock from the copper to secure the latter. When they came upon a large mass they were compelled to abandon it after hammering off projecting pieces, because they had no tools for cutting it up and removing it. Several instances of this sort have been found. The ancient mines were not real mines, not being underground workings, but merely shallow pits or trenches, and sometimes excavations in the face of a cliff. At the time modern mining began they had become mere depressions in the ground. All these workings when examined contained stone hammers or mauls, a few wooden shovels, remains of wooden bowls for baking, birch bark baskets, and some spear or lance heads and other articles of copper.

Wire Tramways.

This forms the subject of a study and investigation with which the Societe Industrielle de l'Est, in France, has charged two of its members, one of whom, Professor Thiery, lately forestalled the definite report by a lecture delivered at Nancy. He concluded by giving the cost of transport on eight wire lines, the mean of which, 57 centimes per ton per kilometer, or 17 cts. per ton per mile, happens to be exactly that of the wire tramway lately erected between Custines and Marbache for carrying ore to the Pont-a-Mousson blast furnaces.

In addition to the low cost of transportation, Professor Thiery enumerated the following economical advantages of wire tramways: They are independent of the land on which they are erected, and which may be hired instead of bought, and cultivated like adjoining portions; there is sufficient height for tipping to dump; they may be established on any land where roads or railways would be impossible, notwithstanding natural obstacles; they will work in any weather, not being interrupted by snowstorms or floods; the loading and unloading is effected in a very simple and practical manner; they may be worked by untrained laborers; and, lastly, the energy stored up in descending may be utilized for ascending, which is not the case with other means of communication.

EXHIBIT OF BRUSH ELECTRIC COMPANY.

Near the southwestern corner in the Electricity building, at the World's Columbian Exposition, is a small staff structure of Greek architecture, apparently built of the purest Italian marble. This structure is surrounded by generators, dynamos, motors and a variety of electrical apparatus displaying all the manufactures of the Brush Electric Company, of Cleveland, Ohio, while the structure itself serves as the office of this company. A general view of this exhibit and of the structure is seen in our first page illustration.

The lighting of this office is one of the prettiest pieces of interior illumination at the Exposition. The room is circular in form, with a diameter of eighteen feet, and with a semicircular domed ceiling. In the center is a column rising through the ceiling. The entire interior is richly colored, and the domed ceiling is so painted as to give it a cloud effect, with a deep blue sky background. An artistic cornice marks the joining of the wall with the ceiling, and the incandescent lamps that furnish the light for the room are concealed behind this cornice and out of the line of vision. There are altogether fifty-two lamps used for this purpose, connected to four circuits, so that the amount of light can be readily regulated, as is frequently required in theaters and other large halls This plan of lighting was devised by Mr. I. R. Prentiss, of the Brush Company, and as adapted to this room has twelve lamps on two circuits and fourteen on the other two. By this manner of illumination there is no need of large resistance coils when the amount of light is reduced, and there is a corresponding saving in the amount of power required when a lesser amount of light is used. The only reflector used is a piece of tin on the inside of the cornice. The rays of light, as shown in the illustration, are thrown on the domed ceiling, and from there diffused throughout the room, giving an exceedingly bright yet soft, mild light that is not in the least trying to the eyes.

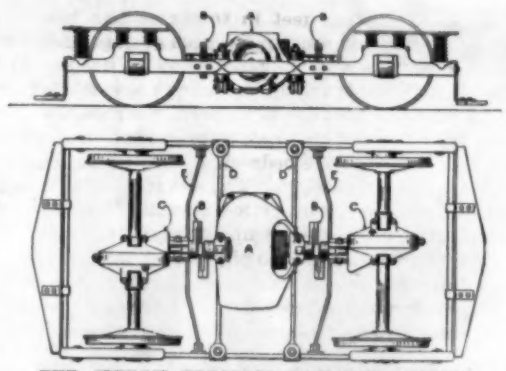
The Brush Company is known the world over for its arc lighting apparatus, and all systems of arc lighting now used are outgrowths of the inventions of Mr. Brush. This is the pioneer company in arc lighting, and it is a remarkable fact that the first Brush dynamo, built in 1876, an illustration of which is given, does not differ, except in unimportant features, from the very last Brush dynamo shown in the lower left hand corner. The chief difference is that the early machine had a Gramme armature, while now a laminated iron core armature is used and open coils. This latest dynamo is the largest arc dynamo ever constructed in this country, and probably in any other. It has a capacity of 120-125 full arc or 2,000 candle power lights. It makes 525 revolutions a minute, and gives 9·6 amperes at 6,250 volts. It is a four-pole machine, and uses two sets of brushes. There are 24 bobbins, and the commutator has 3 rings of 8 segments each. The field magnets are of soft steel and the frame is of cast iron. The shaft is directly connected to a Willans engine, which is set upon the same base, and which works at a steam pressure of 160 pounds. This is believed to be the first direct-coupled arc machine ever built. Heretofore the largest sizes of arc dynamos that have been built have been 65 lights, and several machines of this capacity are shown in this exhibit, as well as the smallest, which has a capacity of one full arc light. Distinguishing features of the Brush dynamos are flexibility, simplicity, and ease of repair. The usual sizes of dynamos have 12 bobbins, making practically three machines in one.

Several dynamos are displayed in this exhibit other than those already mentioned, which are of particular interest, especially the first one that Mr. Brush constructed. Other dynamos are shown that have been run for twelve or fifteen years and have required no further repairs than new brushes and new packing for the bearings.

The display of arc machines comprises twelve sizes—all of the regular sizes manufactured by this company. In addition to this display, the Brush Company has a very handsome working exhibit in the electric plant in the Palace of Mechanic Arts, where there are 16 dynamos, each of 65 lights capacity, forming part of the plant used for lighting the Exposition grounds.

The same system of flexibility that is made such a feature in the Brush arc lighting apparatus is adapted to the alternating system of incandescent lighting, which is now an important feature of this company's business. In the lower right hand corner of our illustration is shown an alternating dynamo of 3,000 lights capacity, giving a current at 2,000 volts and coupled direct to a 250 horse power Brush motor. The armature in this dynamo is stationary. There are ten bobbins, and when coupled in series, give the full output. But this machine as exhibited has the bobbins connected in multiple arc. The incandescent lamps used to illuminate the interior of the office structure derive their current from this dynamo without the intervening use of a transformer. The motor used to run this alternator is a 250 horse power, 220 volt four pole direct current machine, which derives its energy from the Exposition circuits. This alternator has iron segments and uses carbon brushes, and is so constructed as to have great ventilating capacity. Two other alternators are exhibited, one of 1,000 light capacity, the other of 720 lights, and there is also a display of transformers varying from five lights to 225 lights in capacity.

Still another feature of this exhibit, and which illustrates an important feature of the manufactures of the Brush Company, is direct current incandescent lighting apparatus. Four sizes of these machines are shown, the largest one being a 2,000 light capacity. A special feature of this machine is that there is only one turn of wire on each bobbin, giving what has always been regarded as a perfect type of such a machine. The 1,000

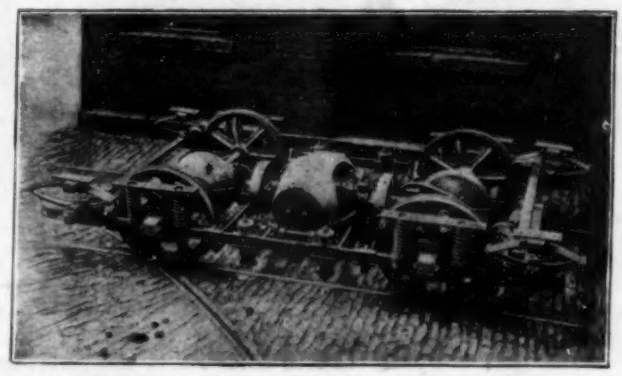


THE SPERRY ELECTRIC RAILWAY SYSTEM, PLAN AND SECTION.

lighter has two turns of wire and the smaller machine more. This 2,000 lighter has great efficiency and generates a very small degree of heat, because of this and other new features in its construction.

The demand for electric power has led to the introduction of power generators and to the making of motors adapted to various purposes to be used in connection with their generators. In the rear of the office structure, but not shown in the illustration, is displayed a generator of 150 horse power capacity. It is compound wound and gives a direct current at a potential of 1,000 volts. It is a type of generator that has come into extensive use for heavy work—the Calumet and Hecla Mining Company using five of them in its mine pumping plant. Several types of motors are shown, one of which, called the mining motor, is very compact and is steel-clad. It is a 220 volt machine and is of very slow speed, the one exhibited being 9 horse power and running at only 700 revolutions. Motors for crane and elevator service, as well as motors adapted to other uses, are also to be seen here.

The exhibition of switchboards is a very fine one. There is a large switchboard adapted to an alternating current plant of 30,000 lights capacity. This board is complete in all of its apparatus, and has just been sold to go to Manila, Philippine Islands, in a plant which the Brush Company is now equipping there. Arc and direct incandescent switchboards are also shown. The principle of flexibility which pervades the Brush apparatus is to be found in the switchboards,



TRUCK AND MOTOR OF SPERRY ELECTRIC SYSTEM.

as everywhere else. These boards are made in panels, each panel representing a dynamo. When another machine is added to the plant, the end panel containing instruments and other apparatus is moved along far enough to permit another panel being placed between that and the panels already in position, so that no change of wires or other unnecessary work need be done to connect up. Another feature and one of much importance, especially on an arc switchboard, is the placing of all live currents on the back of the board, so that the veriest tyro could handle this switchboard and not risk receiving a shock, unless he were careless enough to touch the terminals at the switch.

The space occupied by the entire Brush exhibit is surrounded by a string of arc lamps, and in the evening when these lamps, all of which are of 2,000 candle power, are lighted this exhibit is one of the most highly illuminated sections in the Exposition. The importance and value of the Brush patents on double arc lamps to the commercial world is briefly stated by a modest sign board shown at the right of the office structure, which says, "All double arc lamps used by the Columbian Exposition are furnished by the Brush Company." Another sign board, equally modest, hints at another line of work which has received a great deal of thought and which owes a great deal to the fertile brain of Mr. Chas. F. Brush. This sign reads, "All storage batteries used in electric launches and in the Columbian Exposition are manufactured under Brush patents."

Nearly all the Brush apparatus in Machinery Hall and in their exhibit was sold early in the summer for delivery immediately on the closing of the Exposition, which shows that this apparatus has lost none of its popularity.

The Brush Electric Company does not sell street railway apparatus, but it has allied with it, though independent so far as organization is concerned, two companies that have distinctive apparatus, each of its own peculiar type. In the foreground at the extreme left of the illustration of the general exhibit is seen the exhibit made by

THE SPERRY ELECTRIC RAILWAY COMPANY.

The Sperry system represents a radical departure in electric railway work. This system consists of a single motor mounted flexibly upon a truck frame in the center of the truck. This flexible mounting consists of four rubber cushions between the motor supports and the frame of truck. The motor is thus relieved of all strain and jars and concussion of the axle incident to street railway traffic. By mounting the motor in the center of the truck, the weight on the axle is reduced to a minimum. There is only about two hundred pounds of weight over each axle. It will be acknowledged by all engineers, or those acquainted with railway traffic, that if both axles of the truck are connected with one source of power instead of two, a large increase in traction is thereby gained. This method will soon become indispensable with electric street railway construction, because all of the traction that is possible must be secured. A coupling between each axle and the motor is required, and, from necessity, the coupling must be flexible under some conditions and rigid under others. Mr. Sperry has perfected a coupling that meets these requirements, and a number of them are exhibited. This coupling will allow the pinion shaft, on which is located the "driven," and the motor shaft, on which is located the "driver," to become thrown out of alignment to a considerable extent, while at the same time all of the torque delivered by the driver is transmitted to the driven. This is a very important feature of this equipment, and answers all the objections which have been made heretofore regarding a single motor equipment. In fact, this equipment will round the shortest curves with great ease and with less power required than with any other system.

To show its superior qualities as a hill climber, a grade was constructed on one of the tracks at the World's Fair, and a dynamometer test was held, at which the Sperry car pulled 4,700 pounds on the drawbar before the wheels slipped. A double motor equipment, weighing considerably more, and thereby having that much advantage, was tried, but this equipment only pulled 2,075 pounds before the slipping point was reached. The grade was 12·4 per cent, and the test was witnessed by all the judges of the Electrical Department.

The Sperry Company claim that they rate their motor very conservatively, and that it is built to stand any sudden excess of work which it may be called upon to perform, which in some emergencies amounts to two or three times the rated capacity of the motor.

Street railway traffic is the most severe traffic in the world on machinery. In the first place, the electrical machinery placed under a car is always in crude hands. No special electrical education is considered necessary for a motorman. A man may be a farmhand for forty-five years, and after a few days' run on the road with another motorman he is considered capable of handling and manipulating the electrical apparatus designed to propel a street car. Again, very little grading is done in laying a road, and the machinery must be so designed as to go up hill and down hill continuously. Practically no limit to the load is prescribed, and in most cases the roadbed is allowed to become sadly out of repair before any steps are taken to improve same. Taking these conditions together with the speed at which electric cars are being run, short curves and frequent railway crossings, it is no wonder that the strains incident to street railway traffic are more severe than on any other class of machinery.

The motor designed by the Sperry Company is made so as to stand all the possible strains that can be put upon it, and every feature of the equipment is designed and built with a clear understanding as to the uses to which it is to be put.

THE SHORT ELECTRIC RAILWAY COMPANY'S EXHIBIT.

The special feature of this display, as you will readily see, is a generator in the center. This is a 450 horse

power 500 volt six pole machine, designed especially for electric railway work. The comparative size of the armature of this generator is readily seen from the armature exhibited in the foreground. This shows the manner of its construction and also illustrates one of its striking features, which is a thrust bearing of the same type that is used on the large ocean steamships. This bearing is so constructed that the shaft runs in oil. It is provided with a device by which the position of the armature in relation to the poles can be regulated to the smallest fraction of an inch. The speed of this generator is 300 revolutions in a minute. Its framework is one immense casting 16 feet long.

The railway motor, which the Short Company believes will be the motor of the future, is one that is so constructed as to be practically flexibly suspended in the truck, which relieves it of all strain and jars incident to the ordinary single and double reduction motors. Another very important point is gained by this flexible suspension, and that is, the doing away with the tremendous hammer blows upon the track. The wear and tear on the track by the ordinary motors in use is so great that it would seem that the Short Company are moving along in the right line. The abandonment of all gears is a special feature of the motor, and a very important one from a standpoint of repairs. The development of this motor is rapidly traced in the various stages, from the first one that was built in 1890 to the latest type. This latest type is a six-pole 20 H. P. motor. It is incased, protected from mud and dirt. The working parts are readily reached. This motor is suspended by spiral springs on the car truck. The armature is attached direct to the axle. It has but two brushes and runs without noise.

The rest of the Short exhibit comprises rheostats, motor and generator parts and all other electric street railway supplies.

There are a number of single reduction and double reduction motors exhibited.

DISAPPEARING GUN JARRIAGE.

The question of coast defense has been agitated in this country for many years, without material results so far as fortifications are concerned. The government is partly supplied with heavy guns, with a prospect of more to come, but the mounting and placing of these guns seems, as yet, to be an unsettled matter.

The government has been experimenting at Sandy Hook with a 10-inch breech loading steel rifle which throws a projectile weighing 575 pounds with a velocity of about one mile in 2·6 seconds, the gun being mounted upon Captain Gordon's disappearing gun carriage. The pressure on the breech of this gun is about 3,000,000 pounds, and the problem is to resist the recoil without producing undue strains or shock, and to store and use the power for raising the gun. In the Gordon carriage the gun is mounted on four heavy double cranks journaled on the top of the frame, the arms of each crank being arranged opposite each other. The longer arms support the gun, while the short arms extend downward outside of the frame, and are pivoted to a counterweight frame which surrounds the main frame of the carriage. The counterweight balances the gun and top carriage, so that the only resistance to be overcome in the maneuvering of the gun is the friction on the journals. When the gun is fired, the upper arms swing rearwardly and the lower arms swing upwardly, carrying up the counterbalance. The carriage is brought to rest by pistons working in two hydraulic cylinders provided with an air chamber. By means of this construction, the air pressure, which in the beginning of the movement of the gun is 80 pounds in the air pump, increases at the end of the movement to about 275 pounds per square inch. This energy is stored and utilized in raising the gun preparatory to firing.

In Fig. 1 the gun is shown elevated in position to fire over a parapet; in Fig. 2 it is shown depressed in position for loading.

STATUE OF DUHAMEL DU MONCEAU.

Recently, this carriage has been tried in rapidity tests. Ten rounds were fired in 36 seconds less than an hour, with full service charges of 250 pounds. The weight of the projectile was 575 pounds. The carriage was worked by hand throughout, no power appliances of any kind being used. The value of guns of this character can scarcely be overestimated in the defense of low-lying coast. The guns are exposed only when ready to fire. While being loaded, and at all other times except while actually firing, they are protected by the parapet, and are thus proof against the enemy's fire, and hidden so as to elude discovery.

Fig. 1.—CAPTAIN GORDON'S DISAPPEARING GUN CARRIAGE.

Fig. 2.—DISAPPEARING GUN CARRIAGE—GUN DEPRESSED.

DUHAMEL DU MONCEAU.

On Sunday, the first of October, the city of Pithiviers solemnly inaugurated the statue of Duhamel du Monceau. On this occasion, an agricultural exhibition, with a special competition of dairy apparatus, was organized by the Society of Agriculture, and proved very interesting.

Henri Louis Duhamel du Monceau, who was born at Paris in 1700 and died in 1782, was one of the principal agriculturists of the eighteenth century. Inspector of the marine, he devoted his studies principally to forests. In his *Physique des Arbres*, he was the first to describe with accuracy the laws of the growth of plants, of the formation of wood and bark, of the double circulation of sap, etc. He discovered the *Oidium*, one of the most destructive parasites of the grapevine, and for a long time studied the disease of the saffron. It was in the train of these labors that he entered the Academy of Sciences. He was also a member of the National Society of Agriculture. This learned author of numerous agricultural treatises passed the greater part of the year on his family estate near Pithiviers experimenting upon new agricultural theories, studying fertilizers practically, and occupying himself with perseverance with the enriching of the flora of France through the importation and acclimation of exotic plants.

He was an indefatigable worker, and imposed upon himself the task of laboring twelve hours a day—a rule that he observed during the whole course of his existence. His fortune, which was sufficient to assure him independence, permitted him to devote himself freely to his studies, and to make experiments, which were often very costly, in physics, chemistry, botany, the culture of trees, and meteorology.

He was a philanthropist, and, in his passage to the marine, not content with occupying himself with the improvement of the *materiel* and of the service, and with the construction of posts, lighthouses, etc., he greatly interested himself in the condition of the *personnel*, and published his "Instructions upon the Manner of Preserving the Health of the Crews upon Vessels under Way," a work in which he gives the most practical advice as to the hygiene on board and the preservation of food, and points out one of the simplest of methods of aerating holds by means of a draught of air through the galley stove.

The following is an anecdote concerning him: One day a young naval officer asked him a few questions, to which the scientist answered: "I do not know." "What is the use, then, of being an academician?" replied the young man. Duhamel preserved silence, but, shortly afterward, the officer having become involved in an argumentation that proved his ignorance of the subject, Duhamel retorted: "You see now, sir, of what use it is to belong to the Academy; it is to speak only of what one knows."

The beautiful statue that we reproduce herewith is due to the chisel of the sculptor Blanchard. The pedestal is by Mr. Ratouin, an architect attached to the School of Fine Arts. The savant is represented standing in the attitude of a professor giving a demonstration, and the monument does the greatest honor to the artists who conceived and executed it.—*L'Illustration.*

THE walls of Babylon are said by Herodotus to have been 350 ft. high and 100 ft. thick at the base.

SWORDFISH EXPLOITS.

Several years ago we published an account of a couple of men out in a boat, fishing in the Lower New York Bay, who observed a commotion among a shoal of small fish, and, rowing to the spot, found what they at first supposed, by its single fin above the water, to be a shark. They attacked the monster with a view of capture, and were astonished by the sudden piercing through of their boat bottom by the sword, 4½ feet long, of a large swordfish. They succeeded in noosing his tail, securing and killing the fish, after which he was towed ashore, and subsequently brought up to the city to a restaurant in Park Row, a few doors from the SCIENTIFIC AMERICAN office. The fish weighed 390 pounds and measured 19 feet 8 inches in extreme length. It was certainly one of the finest specimens we ever saw.

The Liverpool *Mercury* gave a report from Captain Harwood, of the brigantine Fortunate, from Rio Grande, to the effect that the vessel, while at sea, was struck and shaken by a swordfish. After discharging the cargo at Liverpool the hull was examined and the sword of the fish found, broken off even with the outside planking. The fish had driven his sword completely through the four inch planking, leaving eight inches of the blade projecting within the vessel.

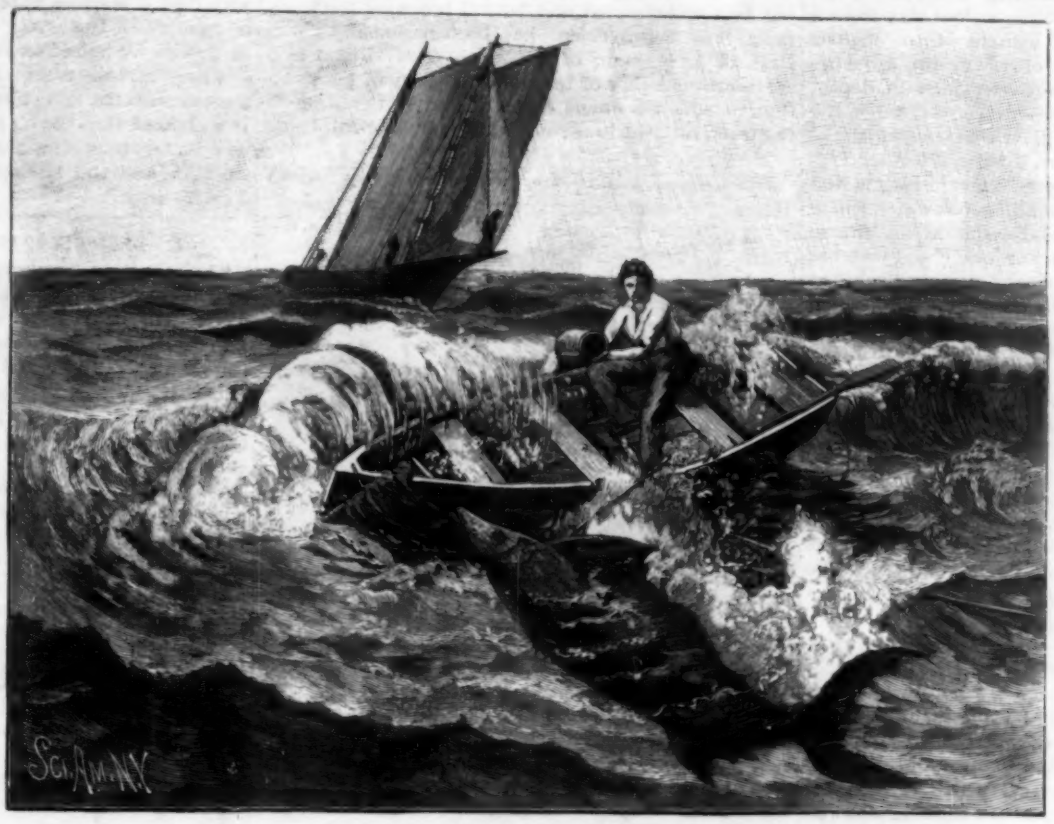
The swordfish is allied to the mackerel, which it resembles in form, and is a swift swimmer. The sword is a most formidable blade, consisting of a strong straight bone, sharp and flat, projecting horizontally from the nose, of which it is a prolongation.

The swordfish is found in considerable numbers off the island of Martha's Vineyard, coast of Massachusetts, at this season of the year. Its flesh is considered excellent food by many persons, and the annual catch is quite large. The ordinary length of the body of the fish at full growth is 14 feet, and its sword 6 feet, or 20 feet in all.

Swordfish have been unusually plentiful off this coast this summer. The fishermen hunt them with harpoons, spearing them from the decks of small sail vessels. In July last the fishing smack Mattie and Lena arrived at Stonington, Conn., after a four days' trip about Block Island, with sixteen large swordfish, averaging 300 pounds each, and an exciting story of a struggle for life between Henry Cheesebro, one of the crew, and a wounded and maddened swordfish.

Cheesebro had harpooned a big fish off Montauk Point, and, after waiting the usual length of time, got into a small boat to bring the apparently exhausted fish to the vessel. As soon as Cheesebro approached him and commenced hauling in the line the fish awoke from his torpor and started to battle for his life. He began operations by diving so as to spear Cheesebro's boat on coming to the surface. Missing his aim, the fish dived again for a second attack.

It was now too late for Cheesebro to retreat, and defenseless, in the frail cedar yawl, he awaited the onslaught. He was kept in suspense but a moment. When the fish shot out of the water once more, he drove his sword completely through the boat from side to side. The sword entered the boat about three feet from the bow, on the port side, and came out through the thin plank on the starboard side. Cheesebro had retreated to the stern of the boat in time to avoid the violence of the fierce fish, and thus escaped injury.



A SWORDFISH PIERCES A BOAT.

His plight was seen from the schooner, and the vessel headed for the scene of the conflict. By constant baling Cheesebro kept his frail and disabled craft afloat until succor arrived. A blow on the head finally killed the fish, and Cheesebro's peril as a sword fisherman was over for this time. The fish weighed 338 pounds.

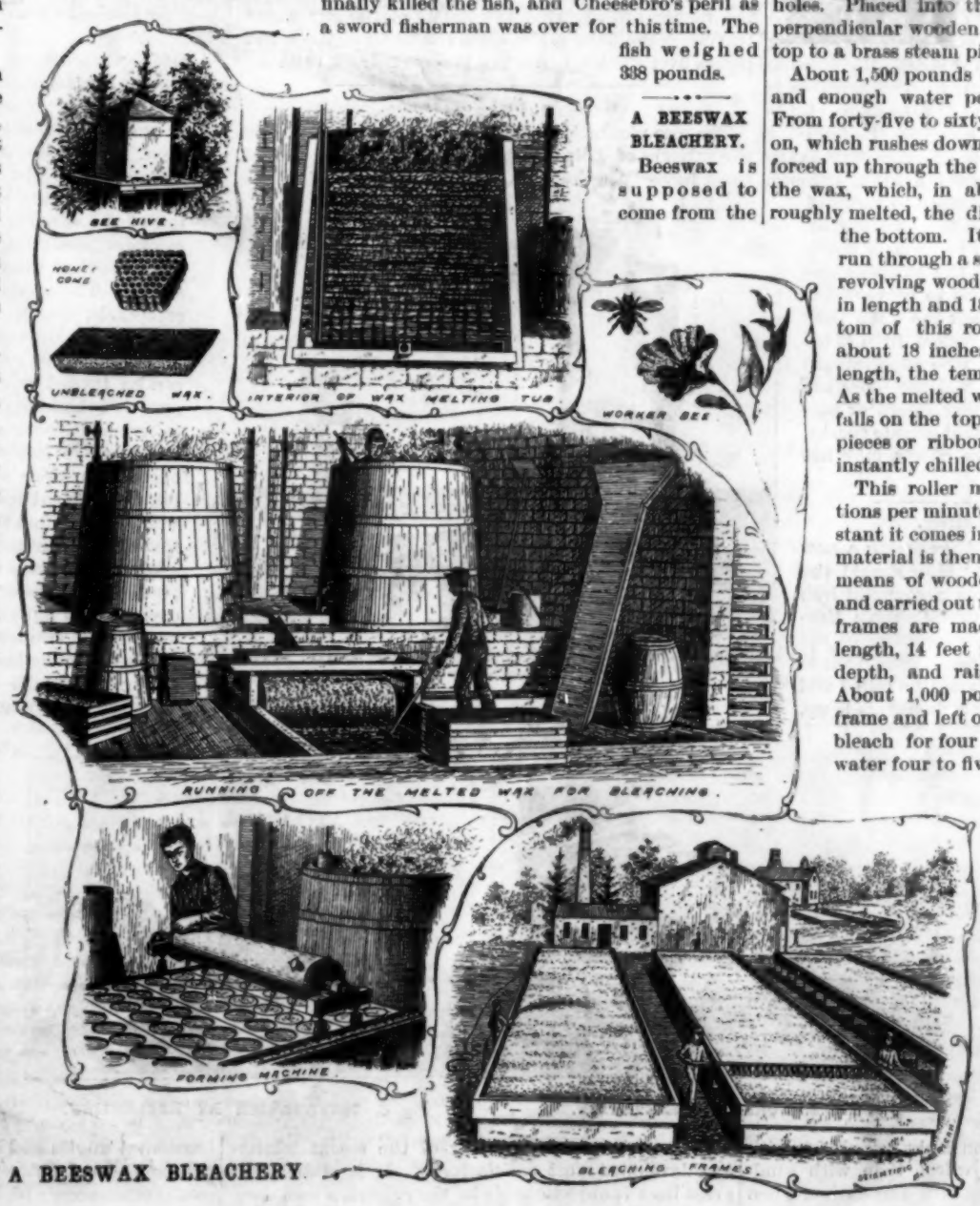
A BEESWAX BLEACHERY.

Beeswax is supposed to come from the stomach of the bee in the form of scales and carried to the mouth with the legs, where a frothy liquor is added to it, causing it to become plastic. In this state it is formed into the cells or comb, in which the bees deposit their honey. The combs are formed in hives built for that purpose, some of which contain colonies of bees numbering from 10,000 to 40,000. Where the climate is warm most of the year round, each hive will average between 350 and 400 pounds of honey. The greatest honey and wax producing States are New York, California, Ohio Indiana, Illinois, Wisconsin, Michigan, Kentucky, North Carolina, and Dakota. These States produce about 800,000 pounds of beeswax yearly. About twenty pounds of honey are required to produce one pound of wax. Large quantities of wax are imported to this country in cakes of twenty-five and fifty pounds each from Cuba and Africa. It comes in two colors, light yellow and dark brown.

Bees that gather most of their honey from grape and tobacco flowers produce the dark colored wax, which is hard to bleach. That produced from clover, buckwheat, etc., is light colored and bleaches easily. The bleached wax is used mostly by sperm candle manufacturers, wax flower makers, druggists, and in the manufacture of carbon paper. The large cakes are first broken up into small pieces and put into a large circular tub or vat made of cedar. This tub is about five feet in height and about three feet in diameter. Across the bottom of the tub are two square hollow wooden pipes, one crossing the other at the center, the tops of which are perforated with a number of holes. Placed into the end of one of these pipes is a perpendicular wooden pipe, which is connected at the top to a brass steam pipe.

About 1,500 pounds of the wax is placed in the tub and enough water poured on to it to swim it well. From forty-five to sixty pounds of steam is then turned on, which rushes down to the perforated pipes and is forced up through the holes and distributed through the wax, which, in about three hours, becomes thoroughly melted, the dirt and grit, if any, sinking to the bottom. It is then drawn from the tub and run through a sieve, where it falls down on to a revolving wooden wheel or roller, about 4½ feet in length and 18 inches in diameter. The bottom of this roller rests in a bed of water about 18 inches in depth and about 6 feet in length, the temperature of which is about 70°. As the melted wax leaves the sieve it strikes or falls on the top of the wooden wheel in small pieces or ribbons, sticking fast and becoming instantly chilled.

This roller makes about sixty-four revolutions per minute, the wax dropping off the instant it comes in contact with the water. The material is then taken out of the water bed, by means of wooden forks, and placed in boxes and carried out to the bleaching frames. These frames are made of wood, about 100 feet in length, 14 feet in width, and about 8 inches in depth, and raised 3 feet from the ground. About 1,000 pounds of wax is placed on each frame and left out day and night for the sun to bleach for four weeks. It is sprinkled with water four to five times daily, to keep the hot summer sun from melting it, as the temperature reaches as high as 120°. Once a day a sixty-four pronged wooden rake is drawn back and forth through the material, which turns it over, allowing the sun to act on every particle. The wax when first taken out to bleach is yellow. After four weeks' exposure in the sun it becomes a creamy white. It is then gathered up and taken back to the tubs and melted over again, going over the same operation and out again to the bleaching frames, to remain out two weeks longer, with the same



A BEESWAX BLEACHERY.

sprinkling and raking operation. This second bleaching turns the wax almost to a snow white, and it is ready to be formed into cakes for the market.

About 600 pounds is then melted up at a time in a tub and drawn off to be made into cakes as needed. These cakes are made by running melted wax from a horizontal movable copper cylinder into circular moulds. These moulds are of heavy tin, 4 inches in diameter and about one-quarter inch in depth, and are placed one after another on a long table, the sides of which are fitted up with tracks, over which the movable cylinder can be drawn back and forth. This cylinder is 10 inches in diameter, 5 feet in length, and double. The outer cylinder contains hot water, which surrounds the inner one, containing about fifteen pounds of melted wax. The hot water and wax are poured into the cylinders by means of capped tubes at each end. Projecting from the outside of cylinder and connecting with the inner cylinder are a number of small hollow tubes, through which, when the attendant turns the cylinder over, the wax runs out into the moulds. As soon as the moulds are filled the cylinder is drawn back again and pushed forward to the next set of moulds, the operation being repeated until the moulds are all filled. To keep the wax from cooling, the hot water is poured when cool, and fresh added after every ninety pounds of wax has been drawn off. The moulded wax becomes cool in about one hour, and it is packed into boxes and ready for market. The sketches were taken from the plant of Theodor Leonhard, Paterson, N. J.

Mysterious Fires.

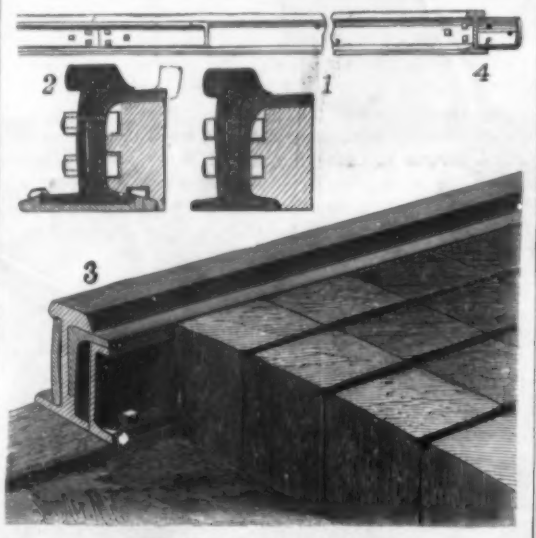
During a recent visit to a country hotel which was lighted by incandescent lamps, Professor John Trowbridge relates that a thunderstorm occurred, and he noticed that the lamps blinked at every discharge of lightning, although the interval which elapsed between the blinking and the peals of thunder showed that the storm was somewhat remote. The effect was doubtless due to induction, produced by the surging of the lightning discharges. On the occasion of a heavy discharge, the lamps were extinguished, although no fuse was burned. This provided an opportunity for an attendant to discover that a jet of gas from a pinhole leakage in the gas fixtures had become ignited (doubtless by a minute electric spark) and the flame was impinging upon some adjacent woodwork. The discovery averted what would have been, perhaps, a serious and mysterious conflagration. The moral of the story is, of course, to be found in the reflection that had the electric light wires not been carried along the gas fixtures, as they were in this case, the ignition would probably not have occurred. This practice is fraught with danger, for if there is a leakage of gas (and what gas fixtures do not leak?) at the joints of the pipes or through a sandhole or other flaw in the casting, then tiny electric sparks arising through resonance effects or from the passage to earth of an electric charge brought into the building by the wires may, if they happen to form in contiguity to the leak, readily ignite the escaping gas without being discovered in time to prevent disaster. If people will cling to their gas when they lay down an electric lighting system, then it behooves the electrical engineer who superintends the work to see that the wires and the pipes are never contiguous, for no lighting guard or protector yet invented can insure that minute sparks, due in some cases to resonance effects, may not arise.—*The Electric Review.*

Water Tank Painting.

"What is the best method of preparing a new steel tank for painting?" and "How should the scale and rust be removed from a common iron tank?" Mr. A. I. Horton, of the Michigan Central Railroad, said, at the recent meeting of the Car and Locomotive Painters' Association, that in preparing iron for tanks it should be rolled and rerolled in the boiler shop before being made up. After the tank is completed it should first be rubbed with sandstone and kerosene, and afterward washed with soft soap and water. Steam should then be turned inside and the tank heated until no moisture appears in the pores or under the scales, and until the lead or paint smokes. As soon as sufficiently cooled it should be puttied and painted. This process gives excellent satisfaction. Mr. Horton also said he had never been troubled with scale on steel tanks as on iron. Mr. F. W. Wright said that the rust could be removed from both steel and iron tanks by rubbing with broken fragments of emery wheel, then with sandstone, and afterward washing with turpentine, when the tank would be ready for puttying and priming.

A RAILROAD RAIL FOR STREET RAILWAYS.

The illustration represents an improved form of rail for street railways, composed of track or running rails proper and supplementary rails bolted to the track rails, and having a laterally projecting top portion serving as a wheel guard and lateral brace for the track rails. The improvement has been patented by Mr. Michael J. Keenan, of Galveston, Tex. Fig. 1 is a cross-sectional view of the preferred form of construction, in which a flange rail is bolted to the inside of the track rail, the lower edge of such flange rail being



KEENAN'S RAILROAD RAIL.

seated on a shoulder formed on the inner side of the web of the main rail, while its flange portion rests on the usual block forming part of the pavement. In Fig. 2 is shown a modified form of the improvement, the lower portion of the flange rail being in this case formed with a base constituting a continuation of the flange of the main track rail, while at curves in the road the flange may have a guard extension, as shown in dotted lines. Fig. 3 shows another form of construction, in which the outer edge of the flange rail is supported on an angle iron running parallel with the track rail, and connected with the adjacent blocks of the pavement. Fig. 4 is a reduced side view of the improvement. The main track rail breaks joints with the flange rails, so that the flange of the car wheel travels on the flange rails when the tread of the wheel passes over the joint between two main track rails.

German Otto of Roses.

The rose plantations established two years ago in the suburbs of Leipzig have been so successful that they have been largely extended. The trees have withstood the severe weather of the recent winters and developed most satisfactorily. It is stated that great heat is objectionable in the culture, a cool temperature and a somewhat moist condition of the atmosphere being the chief conditions of a good yield. A factory has been built in the midst of the rose fields which will consume 50,000 kilos. of leaves daily, and is expected to produce as a minimum about 40 kilos. of essential oil, the estimated value of which, together with that of the rose water and pomade produced, will be from £2,000 to £2,500. Only the requisite quantity of flowers for immediate use will be gathered at any one time, and the roses will be but a few minutes in passing from the trees into the macerating receptacles. It is claimed that the oil produced in Saxony last year was better than the Turkish product, in delicacy, strength, and the lasting character of its perfume.—*Kew Bulletin.*

DELCROIX'S TOPOGRAPHIC RULE.

The campaign topographic rule that we propose to describe appears to us to be destined to render great services. This instrument, which was devised by Captain Delcroix, solves problems relative to a knowledge of the ground, in form and in position, to the study of nature itself, and to the construction and reading of maps. With it, it is possible to lay out a rapid itinerary or an expedite plan, or make a picturesque sketch by the aid of an elementary perspective picture. Six ordinary scales give the reduction of the lengths. A gradient scale permits of rapidly expressing the ordinary gradients. Employed advantageously for the estimation of distances of firing and of lengths of such a nature as the vertical and horizontal stadimeter, the rule permits through a simple observation of measuring a vertical or horizontal angle, or both simultaneously. The topographic rule thus commends itself to travelers, engineers, all those who indulge in open air sports, lovers of sketching and making interesting observations, explorers and members of societies of gun practice, gymnastics, military instruction, bicycling and nautical sports. It will be seen that its uses are numerous.

The apparatus is formed of two juxtaposed instruments, the topographic rule and the protractor compass (Fig. 1). It consists of a flat rule with beveled edges upon which are engraved two triple scales, giving scales multiples of one another. Upon the rear edge, which also is beveled, is engraved the scale of gradients for the equidistance of a quarter of a millimeter of the staff office map and of topographical maps in general, and that too for ordinary gradients of from a half to ten hundredths. Into the front part of the rule is set a spherical level. Finally, upon the long axis are arranged a sighting screen and a back sight.

A protractor compass with rectifiable limb, placed between two transparent glasses, is set, axis upon axis, into the rule. It is graduated by preference into grades or centesimal degrees, in order to facilitate calculations. Upon the upper glass are traced two arrows of alignment at right angles. Four small datum columns keep the axes at right angles and permit of the variable orientation of the limb. The compass needle may be rendered immovable in any position whatever in order to mark the angles. The compass is easily removed from its receptacle, so as to be employed alone. Upon the long axis of the rule, and in front, is arranged an ocular pinule provided with a hinge so that it can be turned down. The variable color of the eyes and the luminous point of the eye may lead to errors of observation. So in the center of the ocular there has been substituted for the human eyeball a copper one, slightly smaller and containing a visual aperture. The visual ray is thus well centered and the sighting assured. At a distance of 100 millimeters from the pinule and parallel with its plane is suspended in a frame a perpendicular translucent mirror of platinized glass, divided into millimeter squares, and upon which are marked two axes at right angles, and so arranged that the horizontal axis of the mirror and that of the pinule form a plane exactly parallel with the lower plane of the rule. The divisions are read to the right and left of the mirror. The vertical frame, being provided with a hinge and rack, can be turned down and made to assume various inclinations. Fig. 2 shows the method of using the apparatus for an ordinary observation, and Fig. 3 for observation by reflection. A light screen of blackened brass serves to shut off the vertical luminous rays, and to protect the glass during carriage.

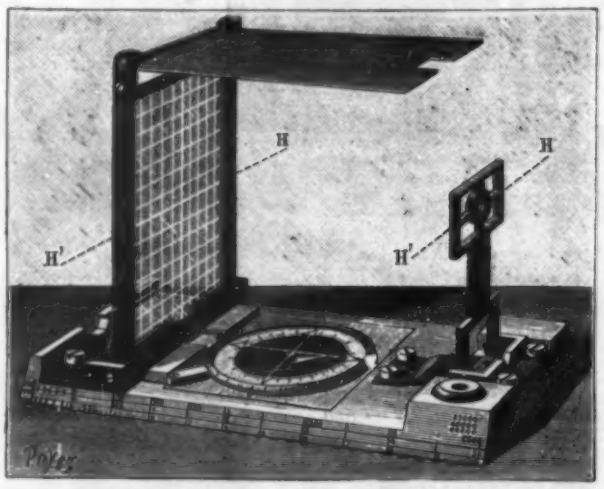


Fig. 1.—DELCROIX'S TOPOGRAPHIC RULE.

Fig. 2.—NORMAL OBSERVATION.

Fig. 3.—OBSERVATION BY REFLECTION.

With this apparatus it is possible to perform the following operations: Measure horizontal angles and lay off distances; measure vertical angles and differences of level; vertical and horizontal stadimetry; picturesque sketching; and reduction of angles to the horizon.—*La Nature.*

EXHIBITS OF THOROUGHBRED STOCK AT THE WORLD'S COLUMBIAN EXPOSITION.

The live stock exhibit at the World's Columbian Exposition was one of the most important and instructive features to attract farmers and others who cultivate the soil and are stock raisers interested in animals. It was noticeable that the attendance jumped nearly 25 per cent as soon as the live stock exhibit was opened, and many people expressed themselves as having waited for this event.

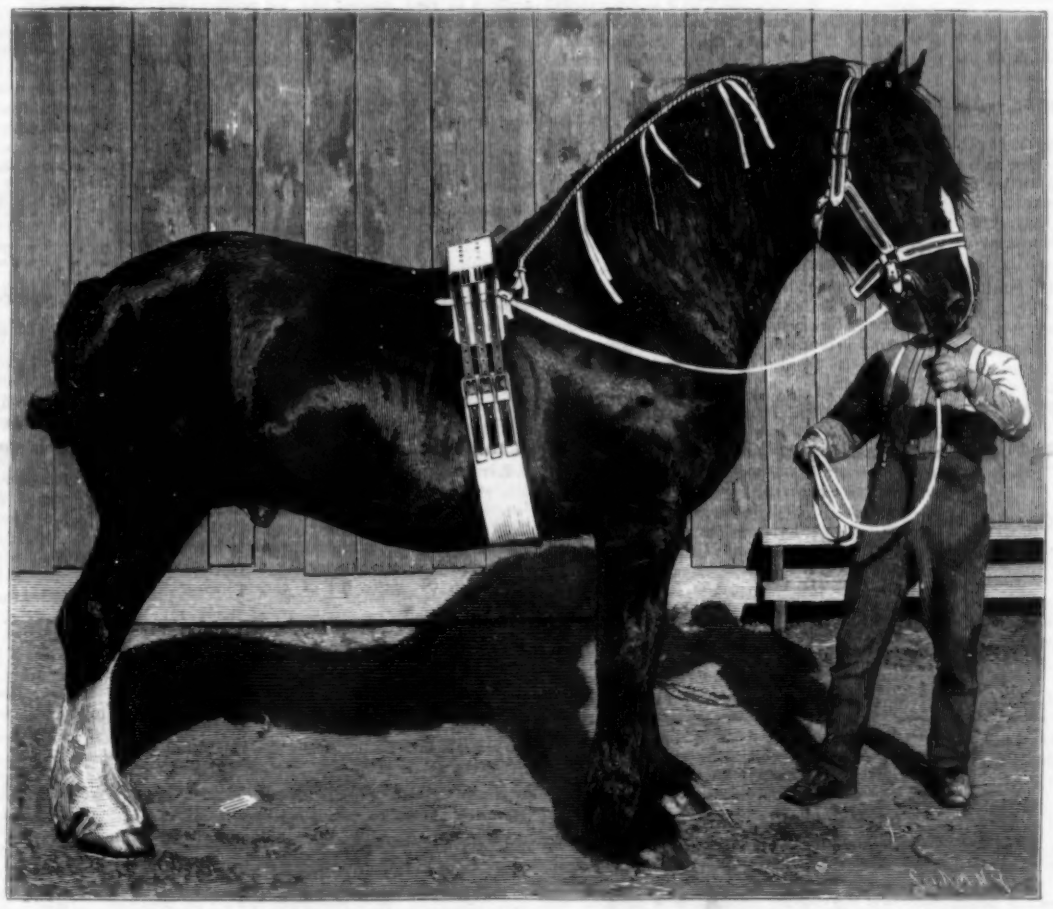
The Exposition management did everything in its power to encourage this exhibit and offered premiums aggregating $150,000, and this amount was increased to the extent of $100,000 more by live stock and other associations interested in the breeding of fine animals. Breeders all over the country took greater interest in this exhibit than in anything of the kind that has ever been held, and several men of large means scoured Europe for the finest animals that could be had. Animals thus purchased were brought to this country primarily to be exhibited at the Exposition, but also with the intent of keeping them here; and as a result of this desire among breeders to excel in their exhibits the country benefits by a great many highbred animals. The very best of every recognized breed was to be found at this exhibition, and in every respect it was the largest and most successful display of live stock the world has seen. It was attended by leading breeders from this country, and the live stock associations of Germany, France, Great Britain and other countries appointed responsible members as delegates to attend. The result of the exhibition will be the dawning of a new era in the breeding of fine cattle in this country.

The Exposition built 40 stables in the south part of the grounds in which to house the stock. These stables were 200 feet long and 42 feet wide and were provided with the latest improvements in the line of ventilation, drainage, stable equipment, etc. The stables were sufficient to accommodate three thousand animals in stalls varying from four feet six inches to ten feet in width, and with the driveways between the buildings covered an area of twenty-seven acres. Animals were never cared for more tenderly. The horses were groomed and exercised and watched with the greatest of care, and the cattle were combed and brushed, their tails crimped and their horns carefully polished each day.

The exhibit opened August 21 and closed October 28, and prizes were offered in each ring or age. Ninety prizes were awarded each of the fourteen breeds of cattle. One of our illustrations last week showed a prize winning cow of the Holstein-Friesians. She, born and bred in this country, is called Walled Lake Queen, and was entered by C. V. Seeley, New Farmington, Mich. She carried away $100 worth of prizes, $50 being the Columbian Exposition prize and the other $50 the sweepstakes prize.

The prize Dutch belted bull shown in our illustration last week was exhibited by H. B. Richards, Easton, Penn., who exhibited a herd of 35 or 40 animals of this breed. In fact, all the animals of this breed belonged to this exhibitor. This prize winner was Byron, who carried away $85 in prizes, which included the first prize in its class and the live stock association prize. He was entered in the class of bulls three years old or over; sweepstakes bull of any age, as well as with a herd. He is an American-raised animal.

Prince Attractive is the name of the prize winning Clydesdale stallion illustrated in our present number. He is owned and was exhibited by Robert Holloway, Alexis, Ill. He was entered in the section of stallions two years old and under three, and he took $350 in prizes—$150 being the Columbian Exposition award and $200 a special prize offered by the American Clydesdale Association, which made a special effort to encourage a fine exhibit of this breed of animals. He also took an extra prize offered by the Great Britain Clydesdale Association.



THE WORLD'S COLUMBIAN EXPOSITION—THE PRIZE CLYDESDALE STALLION, PRINCE ATTRACTIVE.

SOME of the Comstock mines are so deep that no means have yet been devised to overcome the excessive heat.

Manufacture of Soap Powders.

Schreib states (*Chem. Zeit.* and *J. S. C. I.*) that the washing powders or soap powders, which have latterly become important articles of commerce, always contain besides powdered dried soap a large percentage of sodium carbonate, generally in the form of dried soda crystals. These powders may be prepared in either of the following ways:

1. Anhydrous sodium carbonate or soda ash is added to a "clear boiled" soap paste, and after thoroughly mixing, the somewhat stiff material is drawn off into cooling frames. The cold and hard soap thus obtained is then finely ground.

2. Soda crystals and soap are melted together and then treated in the above manner. This method of manufacture, however, is only advantageous where soap scraps are to be had.

A suitable apparatus consists of a wrought iron vessel with a strong agitator contained in an interior cast-iron vessel, which can be cooled by water circulated in the outer vessel. The liquid soap is cooled while the soda ash is slowly added and completely dissolved. During the grinding process care has to be taken not to overheat and thus soften the product.

The composition of soap powders varies considerably. Only a small proportion of resin soap can be used, as such soap is sticky and cannot be powdered. Olein soap may be used with advantage, and the olein may be saponified with sodium carbonate instead of the more expensive caustic lyes.

As a small quantity of free chlorine is not objectionable in soap powder, dark colored materials, such as bone fat, fish oils, etc., may be used for making soap, with an addition of a small quantity of bleaching powder. To some soap powders 2 to 5 per cent of sodium silicate is added. A good washing powder should contain: 30–35 per cent of fatty acid; 30–35 per cent of sodium carbonate; and 30–40 per cent of water. The inferior powders containing only 5–10 per cent of fatty acid should not be used for the laundry; they are only serviceable for scrubbing purposes.

There is a soap powder in the market containing a soap prepared by treating linseed with caustic soda directly. This soap contains certain impurities derived from the seed, which lather freely, and thus when the powder is used, give the impression of more genuine soap being contained in the powder than is actually the case.

Improvement in Half-tone Blocks.

Dr. E. Albert has patented a new method of preparing half-tone blocks, which is stated to be a great improvement. The number of lines on a grain screen varies from 5 to 8 per mm.; more than 8 gives blocks difficult to print, less than 5 gives flat results. The proportion of the intervals between the lines to the breadth of the black lines is 1·1, and this is not the best for the high lights, and for the shadows 3·1 is better. Albert has arranged a micrometer screw on the objective, which is sensitive to 1-30 mm. The action of this is to broaden or narrow the lines, and thus gain the effect required.—*Talbot's Neuheit.*

Diamonds from Coal Gas.

M. Gustave Rousseau recently communicated to the *Comptes Rendus* a remarkable statement referring to his experiments upon the cyclical condensation of carbon. It appears that, in the course of some investigations into the nature of certain manganites, cobaltites, and ferrites, M. Rousseau obtained some metamorphoses which led him to the discovery of a new phenomenon in chemical physics—that is to say, the so-called cyclical transformations to which can be subjected a particular radical under different temperatures. Thus certain compounds of manganese and soda can be formed at a given temperature, changed into something different by raising the temperature, and finally reconverted into the original compound at a still higher heat. From these analogies, says the *Journal of Gas Lighting*, M. Rousseau thought that, if hydrocarbons were heated through the range of temperature between bright red and 3,000° C., there might be produced in turn the various isomeric states of carbon, each of which presents its own degree of stability according to its place in the thermometric scale. It is known that the hydrocarbons form amorphous carbon by decomposition at red heat; while all varieties of carbon are transformed into graphite in the voltaic arc. M. Rousseau claims to have established the novel fact that carbon presents the cycle graphite-diamond-graphite in an interval of temperature comprised between 2,000° and 3,000° C. He worked with acetylene to solve this problem, because this carbon compound has a certain stability at high temperatures, and is endowed with a marvelous plasticity, besides polymerizing easily into a series of carburets more and more condensed. Acetylene was heated in an electric arc furnace, producing both black diamonds and graphite. The experiment was of a difficult character; and much acetylene escaped treatment. M. Rousseau says that the hydrocarbons of coal gas can be made to furnish acetylene, under the action of heat; and in one experiment of 40 minutes' duration, he was able to obtain 20 milligrammes of black diamond in this way: He caused a current of illuminating gas, saturated with the vapor of benzene, to pass into a hollow block of quicklime, where the voltaic arc was maintained. Unfortunately, owing to the leakiness of the furnace, the gas burnt; and after two hours' heating, he could only find a small quantity of graphite mixed with some grains of carbonado. M. Rousseau proposes to continue these experiments, with a furnace hermetically sealed, and constructed of refractory material not containing carbonates. He also intends to substitute for coal gas the highly condensed carburets derived from coal tar or petroleum residuum. Whatever may be the further outcome of these experiments, it is of interest to record that diamonds have actually been made directly from coal gas by simple heating under ordinary atmospheric pressure.

Long Distance Telephony.

The American Telephone and Telegraph Company recently gave an exhibition of their long-distance telephone lines to a small party of guests who assembled at the Telephone building in Cortlandt Street.

Among those assembled to witness the exhibition were Dr. Von Helmholtz, Prof. Alexander Graham Bell, Dr. Hermann Knapp, Miss Knapp, Prof. Seth Low, Prof. Ogden N. Rood, Prof. Geo. E. Deschweinitz, and Mr. Edward J. Hall, Mr. Melville Egleston, and Mr. F. A. Pickernell, of the telephone company, besides some representatives of the press.

A number of receivers were arranged so as to give each of the party a connection to the line. Connection was made with Boston, Chicago, and Washington in turn, and conversations were held with the officers at those points. A cornet was also played which was heard through 500 miles of wire as distinctly as though it were in an adjoining room. The conversation with the headquarters of the telephone company at the World's Fair was held with perfect ease, speaking in an ordinary tone of voice.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—John F. Tiner, Sutherland Springs, Texas. This is an improvement in automatic couplings of the link and gravity pin type, and provides a device which may be set to couple two approaching cars provided with the improvement, and which may be manipulated for uncoupling by the usual lever or chain attachment. In a central recess of the drawhead is a slide block, and in a recess of the block is a vibratable brake bar, while an incased spring-pressed coupling pin slides vertically in the drawhead in front of the slide block, and the pin case has a flexible connection with the brake bar.

Mechanical.

TAP WRENCH.—Frederick C. Williams, 57 Park Hill Avenue, Yonkers, N. Y. This is a strong and simple tool, in which the jaws may be quickly and conveniently operated to receive the dies, and when the jaws are fixed they will be firmly held in place, being clamped by a short turn of a lever. The jaws are held to slide on the beveled surfaces of the walls of the body within an opening therefor, and by means of a lock lever may be locked at any point in the opening. All wear is taken up at each adjustment, and there is an equal amount of strength in both handles.

RATCHET DRILL BRACE.—William P. Nolan, San Francisco, Cal. This an improvement on a formerly patented invention of the same inventor, providing an improved brace in which the speed of the tool shaft can be conveniently changed from a high rate of speed to a single motion corresponding to the movement of the crank arm, or *vice versa*. The frame has a casing with an internal gear wheel, a crank arm turning within the frame, and a ratchet wheel adapted to be locked to the crank arm. A series of gear wheels on the ratchet wheel are in mesh with the internal gear wheel, and a sliding tool shaft has a gear wheel with ratchet teeth adapted to engage the corresponding teeth on the ratchet wheel.

BED FOR MORTISING MACHINES.—Alfred J. Saunders, Port Arthur, Canada. Upon a carriage fitted to slide upon the bed frame is secured a pattern formed with notches arranged according to the mortise to be formed in the stile, while a locking device held on the bed frame is adapted to lock the carriage thereto. The construction is simple and durable, and the improvement is well adapted for convenient adjustment to various sized stiles.

SAWING MACHINE.—Leslie P. Smith, Otego, N. Y. This improvement consists of a table supported at its front edge on swinging legs and at its rear end on a swinging arm, the machine being designed to conveniently support a log and move it to the saw to be cut. The log is fed against the saw by pushing the table rearward, the table swinging on its front legs and on the extension, the cut-off end of the log sagging so that no binding of the saw occurs during the operation.

Mining.

ORE SEPARATOR.—Alonzo C. Campbell, Nashville, Tenn. A reciprocating pan, according to this improvement, is adapted to deliver concentrates from one end and tailings from the other, the apparatus being also designed to serve for washing coal. It is adapted to work successfully on coarse and fine material of different densities, the mechanical movement operating the pan shaking it in such a way as to keep the pulp well stirred up, while water is delivered in nicely regulated quantities to the top and bottom of the material operated upon. The apparatus is also designed to economize space, while it entirely separates the metals from their ores with the utmost rapidity and the least possible expense.

MINERAL LOCATOR.—Robert T. Lacy, Jr., Camden, N. J. This is an instrument to be driven into the earth and bring up samples of rock and minerals from different levels, to determine the value of any location for mining purposes. Combined with a driving rod and pointed bit is a tubular sheath of greater length than the bit, and through the lower end of which the bit projects. There is an adjustable connection between the rod and the sheath, and the lower end of the latter may be converted into a receptacle to gather and hold the material to be brought up from the different levels.

Agricultural.

WHEAT STACKER.—Nicholas Housinger, Sylvia, Kansas. This is a strong and simple machine by which the grain, when placed in suitable receptacles, may be drawn up inclined planes and quickly and conveniently dumped, the receptacle being restored to the vehicle or support from which it was taken. In combination with a vehicle having one pivoted side board are sliding receptacles adapted for a locking engagement, while a track section is pivotally connected with the vehicle supports, an inclined track being adapted to engage with the vehicle track sections, and a tilting platform forming a portion of the track.

Miscellaneous.

AERIAL VESSEL.—Axel F. Bergqvist, Fairfield, Iowa. This vessel comprises a balloon from which is suspended a basket, with propeller wheels at the front ends of both the basket and the balloon, with machinery for driving the wheels and tilting the balloon from the basket. A rudder sail extends from the balloon to a boom projecting from the basket, and the balloon is supplied with gas through pipes connecting with a reservoir in the basket, the driving shaft being operated either by the gas from the reservoir or by other means.

FENCE WIRE STRETCHER.—John H. Gillis, Cornfield, Texas. This is a simple and inexpensive device, quickly placed against a post and secured to a wire, connecting with wires of dissimilar heights, for stretching a wire to any necessary tension. It comprises a beam to one end of which is pivoted a clutch plate having laterally extending serrated arms, a detachable swinging frame on which is a windlass being carried by the beam. A cable carried by the windlass has a wire-engaging hook, and a guide pulley is pivoted on the side of the beam.

TENT.—Benjamin F. Upton, St. Augustine, Fla. This is a tent in which one or two hammocks may be suspended and protected from the weather on either side, or the tent may be practically thrown open to permit currents of air to pass over the hammocks. The tent is especially adapted for purposes of camping out, being foldable in small space when struck, and weighing but little when folded, while being amply strong to support and shelter at least two occupants.

HOOF PAD.—Frank A. Ryan, Sherman, Tex. This is an adjustable rubber pad adapted to be arranged within the shoe of a horse, and having metal braces passing through the pad for engagement between the foot and shoe. A strap from the braces passes from the heel end over and around the foot of the animal. The pad is readily adjustable to a foot of any shape or size, avoiding all contact of metal with any tender part of the foot, and the rubber when worn may be renewed without replacing the metal or mechanical parts. The device may also be used to expand a contracted hoof in a natural and easy manner.

CARTRIDGE SHELL EXTRACTOR.—Rodolfo P. y Cubillos, Bogota, Colombia. This is a device having spring fingers, one of which has two cutting edges at its lower end, while the other has a flattened extremity. The fingers operate conjointly to remove a broken or lodged shell from a rifle, the device being introduced and forced down the grooves, with the fingers compressed, by means of a ramrod, when the shell is cut by one finger as the other passes behind the loosened parts.

CANE LOADING APPARATUS.—George W. Bennett, Bennettsville, La. This is an improvement in devices for loading cane into cars, comprising a basket with a number of connected chains and end cross bars, a hoisting frame or head having supports to carry the cross bars, with means for raising and lowering it and a tripping lever to force the cross bars from their seat on the head or frame. By the apparatus a quantity of cane to fill an ordinary cart may be easily lifted and dumped into the cars so as to lie straight, as it would lie if packed in by hand.

WINDOW SCREEN.—Francis M. Jay, Guthrie, Oklahoma Territory. This screen is secured to a spring-controlled roller journaled in the window frame, a hook being attached to the free end of the screen, while there are hooks in the sash, a connecting S-shaped hook engaging the hook of the screen and the hook on the sash. The arrangement is such that when the upper sash is lowered or the lower sash raised the screen automatically covers the opening which would otherwise be left by the sash.

WINDOW SHUTTER AND CURTAIN.—John O'Donnell, Mountain Lake Park, Md. A curtain made of open chain-like netting, strong enough to resist an ordinary bullet, and also designed to prevent burglars from gaining easy access to a house, is provided by this inventor. The shutter and shade are also so made that it may be easily fastened at any desired height, will run up automatically when released, will serve the purpose of an ordinary mosquito screen as well as a shade, and may be applied to any usual style of window in a building, car or other structure.

FAN MOTOR.—C. P. Elieson, New York City. This is an electrically operated fan comprising a suitable base or support on which turns an electric motor, the armature of which carries the fan, propelling mechanism being also driven by the armature to revolve the motor itself. By the slow revolution of the motor and the more rapid rotation of the fan, a better circulation and more even distribution of the air is effected than can be obtained by the ordinary fan movement.

VEIL FASTENER.—William H. Harrison, Newark, N. J. This is a simple device, readily applied on the ends of a veil, to facilitate tying it in the desired position without danger of its becoming unfastened. It consists of two coupling members, each provided with loop-forming veil end adjusters, one of the members having an eye with its front bar widened near the middle, to be engaged by a hook on the other member, the hook being formed of curved bars united by a connecting bar formed with an inward bend.

MOSQUITO NET FRAME.—Harry H. Rumble, Norfolk, Va. According to this invention a top or canopy frame, extending over the head of the bed, is attached to the head board, and an edge frame, preferably made of strong light wood, as bamboo or cane, is removably attached to the bed on a level with the lower edge of the bed rails. The net is thrown over the top frame and bed, while its edges are secured to the edge frame. The application of the two frames to the bed is very simple, and the frames may be easily taken apart and stored in small space when not in use.

IRONING BOARD.—John E. Tracy and Arthur N. Graham, Chicago, Ill. This is an improvement in that class of ironing boards adapted to be attached to and receive partial support from a table. It is of very simple and inexpensive construction, and the board is adapted to automatically clamp one of its ends fast to the edge of the table when the prop support of the board is swung into position to hold the board up in position for use.

LAUNDRY TONGS.—Thomas Eagan, New Haven, Conn. This is a very cheap, simple, and convenient implement, which may be made to answer the purpose of an ordinary clothes stick, and is adapted to be dipped into a boiler of hot water to pick out articles, grasping a collar button, collar, or other small thing, while also strong enough to lift large articles.

INKSTAND AND ATTACHMENTS.—Willard C. Eldridge, Chicago, Ill. This improvement comprises a unique and advantageous combination of parts embodying in compact arrangement many necessary adjuncts of a desk or writing table. Combined with the supporting stand for ink wells are postage stamp holders, pen remover, penknife sharpener, pencil sharpener, card holder, pen rack, bill file, pen holders, a universal calendar, a pen wiper, and pincushions, etc. The entire device may be made of metal, suitably ornamented.

ENVELOPE.—Malcolm Scougale, Fort Worth, Tex. Two overlapping end flaps, according to this invention, are connected with each other by a band, forming, with the front, an expansible pocket for the accommodation of a large number of letters, documents, or other matter, a top flap and a bottom flap being adapted to fold one above the other, and both over the end flaps, while a band holds the top and bottom flaps closed.

FRAME FOR BLOTTERS.—Adolph Ludwig, Brooklyn, N. Y. This is a frame between which several sheets of blotting material and a cover may be conveniently clamped, the frame carrying a locking device which is passed through the pad. In addition to binding the blotting sheets, the frame may be employed to disclose a shifting calendar, or to receive and disclose a photograph, a memorandum tablet, or other articles for ornamentation or use around a desk.

TEETH GRINDING DENTAL APPARATUS.—Daniel E. Morse, New York City. This invention provides a method of and means for rapidly fitting and joining adjacent block sections of porcelain or other artificial teeth. The method consists in removing the block sections from their mould in the position they occupied thereon, and then grinding the adjacent edges of the sections on parallel grinding faces. A frame is also provided having sliding carriers adapted to hold the adjacent block sections.

FRAME FOR MAIL BAGS, ETC.—George A. La Fever, Selkirk, N. Y. This is a frame applicable to any character of bag in which it is desirable to have the mouth held open or to hold the mouth readily closed. It is composed of rigid sections united by hinged connections in such manner that the sections may be folded out in rectangular form, or folded one upon the other to form practically a long flat bar. Two of the members have projecting flanges, which, when the frame is opened, will be at diagonally opposite corners, enabling the bag to be suspended in a ready and convenient manner.

PRINTER'S CHASE.—Harry S. Foster, Albany, N. Y. In a chase of the usual kind, in which matter is locked by the use of the ordinary furniture, an angular form may be arranged in one corner, or such other position as desired, by the use of this improved chase, which has an outer square frame with an inner circular ring on which is a graduated scale. The ring has a shoulder on its inner side on which rests and turns the shoulder of an inner circular chase, having faceted or flattened inner sides, for convenience of locking up matter therein. The inner chase also has gauge marks to register with the graduated scale, whereby it may be nicely adjusted to position and insure a perfect register.

BABY CARRIAGE BRAKE.—Milton W. Bohn and James H. Machen, Norfolk, Va. This is a simple and inexpensive device which will lock the vehicle from movement except when it is being propelled by the attendant. The brake is held normally in engagement with the wheel, and there is a connection between a hand hold adjacent to the handle and the brake, whereby the attendant may, in propelling the vehicle, also hold and retain the brake out of engagement with the wheel.

BED BOTTOM.—James W. M. Witt, Cedar Bluff, Ala. The corner stays, according to this improvement, have hooks, with which are connected the stay rods and mattress support, while coiled springs depending from the sides of the bed support the mattress frame and retain each slat thereon independently of the other, so that one may yield without interfering with the others.

SPRING BED.—William M. Myers, Hannibal, Mo. According to this improvement the springs are so supported in connection with the headboard that the springs may be shipped and stored in connection therewith, and the same devices for holding the spring to the headboard may serve to give tension to the spring. The construction of the spring is such, also, that it may be adjusted in reasonable limits to suit beds of different widths, and will be comfortable and easy at any width.

CLOTHES PIN.—John W. Cook, Harrisburg, Oregon. A piece of wire is bent about midway of its length to form a spring clasp to hold the clothes, the wire being then twisted to form two oppositely disposed eyes to which a drawing cord may be attached, and the ends being curved and lapped to form an open supporting eye. It may be used with a pulling or drawing cord to stretch articles along a line, without leaving a fixed position, and the pin may be readily attached to and detached from a line without interfering with other pins.

ERASER.—George Freund, Durango, Col. On one end of this eraser are a burnisher and abrader, on opposite sides of the implement, and on the other end is an arrow-like scraper head having a marginal groove in both edges forming an increased number of scraping edges.

MUSIC CHART.—James H. Brady, William A. Whitehead, and Samuel J. Shea, Frankfort, Ky. This chart should be made of heavy cardboard or similar material, about twenty-three inches long and six inches wide, and in use is to be placed edgewise upon the rear portion of the keyboard. It is divided into major and minor sections, and arranged to indicate clearly to an inexperienced person the keys of a piano, organ, or similar instrument to be struck to produce the several major and minor chords of the key to which the chart has been applied.

MAKING UNINFLAMMABLE FABRICS.—Carl Raswitz, Berlin, Germany. The preparation of textile fabrics by means of ammoniacal oxide of copper, according to an improved process, is the object of this invention. The fabrics are dipped in a solution of vegetable parchment in ammoniacal oxide of copper, the ammonia is then evaporated and the fabrics treated with sulphate of ammonia and acetate of alumina to remove the copper and render the fabric uninflammable.

UTERINE DILATOR.—Arthur J. Beavis, Aspen, Col. This is a simple surgical instrument for the rapid and safe dilation of the cervical canal and urethra, with ease to the operator and safety to the patient.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SOUND SENSE IN SUBURBAN ARCHITECTURE: CONTAINING HINTS, SUGGESTIONS, AND BITS OF PRACTICAL INFORMATION FOR THE BUILDING OF INEXPENSIVE COUNTRY HOUSES. By Frank T. Lent, architect, with illustrations by the author. Cranford, N. J.: Frank T. Lent. 1893. Pp. 98. Price $1.

This very pretty work by a New Jersey architect contains very good suggestions for cottage residences, illustrated by drawings in many cases from buildings erected in this vicinity. For those contemplating alterations in country buildings, there is no question that many excellent hints can be found, as well as for those who have in mind the possibly more critical operation of complete building.

THE DYNAMO: ITS THEORY, DESIGN, AND MANUFACTURE. By C. C. Hawkins and F. Wallis. London: Whittaker & Co. The right of translation is reserved. 1893. Pp. xiv, 530. Price $3.

It is fair to assume that in the present days of progress of electrical engineering every new work will embody something new. Whether in the face of the recent publications it is necessary to produce a new work on the dynamo is questionable, yet it is undoubted that the present work will fill a space, as being more popular and less expensive than such works as we have alluded to. It is fully illustrated, contains a reasonable quantity of formulæ without being too mathematical for the every-day practical engineer, and is very fully illustrated in examples of recent practice.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Minerals sent for examination should be distinctly marked or labeled.

(5448) E. E. S. says: I send you herewith a piece cut from an ash tree, together with an insect found on the same. The entire tree is covered with a similar incrustation and is apparently dying. Please tell me through Notes and Queries what the insect is and the remedy, if any. A. Reply by Professor C. V. Riley.—The section of ash limb sent is densely incrusted with the scales of the oyster shell bark louse, a well-known pest of the apple tree, which also infests a great variety of other trees and shrubs. The larger insect referred to is an immature plant bug belonging to the family Pentatomidæ, carnivorous in habit, but having no connection whatever with the bark louse except that it might occasionally feed upon it, though normally foraging on larger insects, such as the larvæ of Lepidoptera. A more thorough infestation by this scale, which seems to have covered the limb to a depth of several layers, is not often seen, and it can easily be imagined that the injury resulting from the attacks of myriads of the insects would be very considerable. This scale receives its common designation from its general resemblance to an oyster shell, and covers a soft-bodied, almost organless, insect which, beneath this protective covering, extracts the juices of the plant tissue by means of a long sucking tube. All the other organs, feet, eyes, mouth parts, antennæ, etc., have disappeared, leaving it practically a segmented bag with a sucking tube. This scale, in common with all others of its kind, is not always in this degraded, helpless condition, but in the larval stage is provided with six legs and other appurtenances of insects, and runs rapidly about until it finds a suitable location, where it fixes itself and begins the exudation from the surface of its body of a waxy powder which, by constant accretions, forms the waxy scale of the mature insect. In the meantime, in the first moult, all the members of the body except the proboscis are shed and abandoned, and the insect thereafter merely increases in size without other change. On reaching full growth the female becomes filled with eggs, which ultimately give birth to the new generation. The history of the male scale is widely different from the above. Starting out in a similar way, it does not, however, attain the size of the scale of the female, and after the second moult it enters into the pupa state, and later emerges with delicate wings, resembling very much a minute gnat, and then soars about in quest of its mate. The history outlined above is practically the same for all the scale insects, the number of generations in a season depending very largely on the latitude. In the warmer sections of the country one generation follows another without a break, while in more northern States perhaps but a single generation is produced annually. In a case of infestation so bad as that of the ash tree in question, the chances are that it will have been so weakened that it will be useless to adopt any remedial measures, and it will in all probability be far better to cut down and burn the tree. The application of kerosene emulsion to the plant is the best remedy known, care being taken to wet thoroughly all the affected portions. If the application is made during the growing season, a dilution of one part of the emulsion with 15 of water is desirable. It is often advantageous, however, to apply a much stronger solution during the dormant season, at which time a dilution of one part of emulsion in 5 parts of water will do no injury to ordinary deciduous trees, and will be much more effective against the scales. If a careful watch is kept on the trees in early spring, the period when the eggs hatch will be noted by the emergence of the young and their spread to other parts of the tree. The application of the insecticide at this time will be especially effective on account of the unprotected condition of the young lice.

(5449) E. F. F. asks: What is the velocity of steam through a 1 inch pipe at 100 pounds pressure, and if a 4 inch pipe would be four times as much or more? A. The velocity of steam flowing into the air through an orifice or from the end of a short tube is 898 feet per second at 100 pounds pressure, varying but very little for differences of pressure; but the absolute quantity in pounds varies very greatly, being 39 pounds of steam per minute at 30 pounds pressure and 98 pounds per minute at 100 pounds pressure for each square inch of orifice. The increase in the size of the orifice gives only an imperceptible increased velocity, due to proportional decrease of friction on the edge of the orifice. It is the quantity that is increased by the larger orifice and in the ratio of its area.

(5450) G. P. N. says: Please give me the formulas for making sympathetic ink which require the aid of chemicals to produce the writing, also that require heat to bring out the writing. A. 1. Inks appearing through reagents. Characters written with a very weak solution of chloride of gold will become dark brown upon pouring a solution of perchloride of tin over them. Or characters written with a solution of gallic acid in water will become black through a solution of sulphate of iron, and brown through the alkalies. 2. Ink appearing by the application of heat. Write upon rose-colored paper with a solution of chloride of cobalt. The invisible writing will become blue through heat and will disappear on cooling.

(5451) S. F. says: 1. Will you please let me know what will remove fruit stains from linen? A. Most fruits yield juices which, owing to the acid they contain, permanently injure the tone of the dye, in colored goods, but the greater part may be removed without leaving a stain, if the spot be rinsed in cold water in which a few drops of aqua ammonia have been placed before the spot has dried. Wine or fruit stains on white materials may be removed by rinsing with cold water, applying locally weak solution chloride of lime, and again rinsing in an abundance of water. Some fruit stains yield only to soaping with the hand, followed by fumigation with sulphurous acid, but the latter process is inadmissible with certain colored stuffs. If delicate colors are injured by soapy or alkaline matters, the stains must be treated with colorless vinegar of moderate strength. 2. Also medicine stains in which iron and iodine were the principal ingredients. A. Try dilute hydrochloric acid, followed by ammonia. It is probable the iodine has rotted the goods so that any attempts to remove the stain will end in failure.

(5452) R. H. C. writes: Will you kindly give me a receipt or any suggestion how to remove fly specks from wall paper? I have a room papered with expensive paper, badly stained this past summer with fly dirt, and would like to learn of some remedy to remove them. A. Bread crumb not too fresh will answer to clean wall papers. Grease spots may be removed in some cases by using ether.

(5453) R. W. G. asks: What solution is used in tempering tools for granite cutting? What for marble? A. A tool that is of the best temper for granite is also the best for marble. It should be hard and tough for any use. More care in the heating and drawing the tools, so as not to burn the steel, is required than is generally given. A half pint of salt to one gallon of water is the best chilling bath. Dip endwise, and draw to the desired color for toughness.

(5454) V. L. W. asks: 1. Will you receive a shock by touching one wire or one pole on an alternating dynamo of 2,000 volts or more, being perfectly insulated from the other wire or pole? A. A comparatively slight shock may thus be received, owing to charge and discharge of the body. 2. Will you get a shock from one wire of an alternating dynamo of 2,000 volts or more through the insulation one inch thick, one wire grounded? A. Practically none if the insulation is of ordinarily good quality. 3. Is there any dynamo or any electrical machine that requires only one wire to convey the current, no ground being used? A. A true current requires a circuit. In Tesla's high frequency experiments, the luminous and incandescing effects of currents are produced without return circuits. See Tesla's "Experiments with Alternate Currents," $1 by mail.

(5455) F. T. writes: In your issue of September 9, you give a list of metric equivalents, one of which is, to convert gallons to liters, multiply by 3·8. Is this right? Should it not be 4·543? A. The factor 3·8 applies to the United States gallon of 231 cubic inches; the factor 4·543 to the imperial gallon of 277·27+ cubic inches.

(5456) F. M. W. writes: 1. I have a solution for copper plating made according to the first receipt in SUPPLEMENT, No. 310, except that by mistake I added a large excess of cyanide of potassium. Articles in circuit in it receive no deposit. Would the excess of cyanide cause this? If not, what would? If so, can I do anything to set things right or is my solution useless? A. Too much cyanide will tend to prevent precipitation. To rectify it add more copper sulphate and dilute in proportion. 2. In replating articles should all the old plating be removed in all cases? A. It is decidedly better to completely strip before replating. You also gain a certain amount of silver thereby. 3. How much prussic acid (dilute) does it take to precipitate 21 drachms of nitrate of silver? Would an excess of water in the nitrate solution use up more acid? A. This cannot be answered, as you do not tell how dilute your solution is. One part by weight of pure prussic acid combines with the silver contained in six and three-tenths parts silver nitrate. More water does not require more acid. 4. I have 1 Bunsen cell (2 quarts). Now if I expose the zinc surface equal to the surface of work in electroplating bath, will it be all right? Are the battery and solutions well balanced? A. No such general rule can be given. Your battery surface may exceed the anode surface in the bath. Regulate by different immersion of the anode, not by changing the battery surface. Do not use too strong a current, *i. e.*, too large an anode. 5. Is there any United States standard of screw threads under ¼ inch? If so, please give table. A. There is no United States standard for screw threads under ¼ inch. Manufacturers have adopted standards of their own nearly corresponding with English practice.

(5457) J. J. L. says: I read the SCIENTIFIC AMERICAN, but cannot quite catch on to one question—the cost of transmitting electric power. I had better give a supposed case. I have a 70 horse power water power turbine wheel. It will cost me $5,000 to run a canal from the dam two miles and put in a turbine at the end of the canal. What will it cost to transmit that 70 horse power or 80 per cent, or say ½—35 horse power—two miles, and apply it to the machinery there? What does it cost to carry 30 horse power two miles by wire and apply it at that distance from the water power? I know there must be a dynamo at the starting point and there must be a motor where the power is applied. What cost say of 30 horse power dynamo and motor, or any horse power, say 10, 15, 20? Next, is it practical, say to carry a saw mill or ore mill or mine lift into a mountain and use water power two miles away to run it? A. If your turbine has an actual output of 70 horse power, you should be able to realize 50 horse power at 2 miles without difficulty by electric transmission, by running a 70 horse power dynamo at the location of power, and any required number of electric motors up to a total of 50 horse power at various points two miles distant, at a total cost somewhat more than you quote for a canal. The 70 horse power dynamo will cost about $2,000, and as much more for the motors, including regulators. The wiring will foot up another thousand dollars. Shafting and belting with a house must be also provided. The care of such a power plant is much greater than by the canal system, needing the constant attention of at least one man. If 30 horse power only is required, $5,000 will cover the whole cost. A 10 horse power motor will cost $500, 20 horse power $800. The transmission of power is perfectly practicable and is largely in use in mining and for mechanical purposes.

(5458) J. E. E. asks: 1. Is it possible to light a kitchen fire with the current of one or two ordinary cells? A. It is possible to kindle a fire by such agency? 2. Kindly describe method. A. Carry the wires to the grate and connect them by an incandescing fuse. This may be made of a very short piece of thin iron wire stretched over some sulphur on a block or piece of kindling wood and partly embedded in the sulphur. When the current is turned on, the wire will become hot and will ignite the sulphur. This will ignite the wood. A LOW fuse must be used for each lighting. 3. Describe a fusion valve. A. A poppet valve may have its poppet held down by a strip of fusible alloy stretched across the opening. If a fire occurs, the strip melts and the pressure drives the poppet away. 4. How many horse power does it take to run the dynamo of SCIENTIFIC AMERICAN SUPPLEMENT, No. 865? A. Six to eight horse power.

(5459) M. F. writes: 1. We have an electric light system here which runs lights until about midnight. Can I use the current supplying incandescent lamps, of 110 volts, to charge a storage cell to furnish current for a lamp for the balance of the night? A. Yes. For charging use a current of proper amperage, using a resistance coil to determine its strength. The battery is made to be charged by a definite current, and on this account you must have your resistance. Use wire large enough not to get too hot. 2. What size storage cell would be needed, and how many candle power would be practical for the lamp? A. The capacity of the cell answers this with one proviso. You cannot use less than thirty cells in series to get good voltage. It is far better to use special low resistance lamps for your battery service.

(5460) T. L. C., G. L., and others ask how to mount photographs on glass. A. Take 4 ounces gelatine and soak half an hour in 16 ounces of water, put the jar in a large dish of warm water and dissolve the gelatine. When dissolved, pour into a shallow tray. Have your prints rolled on a roller, albumen side out, take the print by the corners and pass rapidly through the gelatine, taking great care to avoid air bubbles. Hang up with clips to dry; when dry, squeeze carefully on to the glass. The better the quality of glass, the finer the effect. G. L. also asks how to keep fish glue in a liquid state. A. Use 16 parts by weight of nitric acid to each 100 parts of glue and 250 parts of water.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

October 24, 1893,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading or polishing materials to cutting and polishing tools, device for supplying, J. Camberon 507,212
Advertising balloon, E. S. Reed 507,185
Aerating apparatus, B. F. Tatman 507,303
Alarm. See Fire and stable alarm. Railway alarm.
Amalgamating machine, S. W. Vale 507,405
Animal trap, W. H. Castle 507,417
Animals, means for transporting seminal fluid of, J. S. Wintermute 507,195
Armature coil for dynamos, G. Wilkies 507,297
Armature, dynamo, J. J. Wood 507,194
Atomizer, W. H. Payne 507,193
Automatic switch, F. A. Chapman 507,353
Axle box, car, Kinsell & Leavens 507,141
Axle box lids, guard attachment for car, Busenbens & Woltmann 507,195
Axle, wagon, G. W. Taylor 507,181
Axles, shoulder cutter for vehicle, J. Sovereign 507,389
Basin waste or overflow, H. C. Montgomery 507,207
Bathtub leg, W. Bunting, Jr 507,209
Bathing apparatus, electro-thermal, W. F. Howe 507,367
Battery. See Secondary battery. Storage battery.
Bearing, roller, E. F. Morse 507,153
Bearing, roller, Purdon & Walters 507,159
Bearing, spindle, G. O. Draper 507,355, 507,365
Bed, folding, A. M. Brainard 507,102, 507,104
Bed rail holder, A. G. McLaurin 507,326
Bee escape, R. J. Stead 507,505
Belt, conveyer, R. Niedergesaess 507,156
Bicycle, A. Fyrberg 507,116
Bicycle, E. Warwick 507,513
Billiard cue, R. N. Barger 507,471
Binder, temporary, C. T. Rosenthal 507,386
Bleaching, etc., apparatus for and process of, E. Bents *et al* 507,404
Board. See Ironing board. Matrix board. Tally board.
Boat. See Life boat. Portable boat.
Bobbin or spool, Haynes & Wilcock 507,134
Boiler scale, apparatus for removing, H. Banchy 507,203
Boilers, pipe or flue connection for steam, H. E. Harrington 507,331
Bolt, T. Lafon 507,377
Book backs, machine for forming, Friedrichs & Brede 507,115
Boot nailing machine, R. W. Bateman 507,472
Border or edging for fabrics, J. M. Merrow 507,224
Bottle washer, R. Rushmore 507,390
Box. See Mail box.
Bracket. See Shade hanger bracket.
Brake. See Car brake. Pressure brake. Railway slot brake. Vehicle brake. Wagon brake.
Brick kiln, continuous, C. F. Kaul 507,374
Brick machine, dry press, Blanks & Lefebure 507,477
Brick or tile machine, G. S. Tiffany 507,249
Brush, shaving, H. J. Smith 507,482
Buffing or polishing wheel, J. Chase 507,234
Buildings, facing, J. W. Graham 507,450
Burial casket lid, Stein & Rappleyea 507,292
Bust supporter, L. Lendry 507,373
Button drilling machine, E. J. Ostick 507,384
Cable crossing guard, J. W. Hentz 507,497
Can. See Sheet metal can.
Can opener, D. B. Sanford 507,171
Car brake, J. R. Cribbs 507,311
Car brake, Wilson & Fetzer 507,469
Car coupling, E. D. Bond 507,102
Car coupling, E. L. Meigs 507,376
Car coupling, Sweet & Sessions 507,180
Car coupling, C. A. Tower 507,511
Car coupling, W. C. Watson 507,296
Car draught device, J. Timm 507,288
Car heating apparatus, T. R. Yates 507,302
Car platforms, folding gate for, W. S. Adams 507,092
Car safety device, street, J. M. Kelly 507,138
Car safety fender, tram, H. S. Robins 507,167
Car step, folding, M. E. Campany 507,415
Car wheel and axle, G. W. Fairman 507,205
Cars, automatic safety attachment for street, C. E. Baggesen 507,201
Carbon dioxide, apparatus for making, E. Lubmann 507,143
Carpet fastener, stair, A. C. Kaster 507,517
Carrier. See Freight carrier. Trace carrier.
Cash register, H. A. Bierley 507,356
Cash register, C. F. Hamilton 507,120
Cash register and indicator, J. A. Barnes 507,097
Cash register and indicator, T. Carney 507,351
Cash register and indicator, L. Ebrlich 507,213
Cash register and indicator, W. W. & W. H. Wythe 507,301
Casting, J. C. Hill 507,265
Chain, drive, W. H. Hart 507,362
Chain, making, I. L. Atwood 507,346, 507,347
Chain making machine, F. Esse 507,268
Chair and sofa bed, L. Hirschfeld 507,270
Chuck, screw machine, A. C. Fitz 507,315
Churn, Cameron & Potter 507,414
Cigar bunching machine, L. T. Cornell ..... 507,[illegible]
Cigar bunching machine, Smith & Pease ..... 507,[illegible]
Clamp. See Paper clamp.
Clamping machine, W. Horrocks 507,131
Cleaner. See Flue cleaner. Grain cleaner. Harrow cleaner. Pipe trap cleaner. Trolley wire cleaner.
Cleaning compound, Basile & Partridge 507,473
Closet. See Dry closet. Water closet.
Cloth pressing machine, Kirk & Lee 507,229
Clothes line, chain, H. S. Percival 507,161
Clutch, Gable & Detrick 507,117
Cock or faucet, J. H. Savill 507,456
Collar, horse, R. Brownson 507,209
Commutator brush holder, J. J. Wood 507,344
Concrete pipes in situ, manufacturing monolithic, E. L. Ransome 507,521
Connector, C. Bell 507,403
Cooker, steam, W. J. H. Gluck 507,359
Cooking utensil, A. W. Obermann 507,281
Cooking utensil, bean, N. Ames 507,199
Core, green sand, C. F. Bingham 507,468
Corset, E. R. Caperton 507,482
Cotton conveyer, seed, F. C. Gammons 507,366
Coupling. See Car coupling.
Crane, H. Aiken 507,305
Crate, carrying, Moss & Hillyard 507,446
Creamer, centrifugal, A. Lentsch 507,442
Crocheting machine, G. D. Munsing 507,208
Crushing or grinding machine, C. Rimpler 507,140
Cultivator, W. F. Cochran 507,309
Cultivator, combination, W. S. H. Wailes 507,295
Curling iron, W. M. Cleeland 507,108
Curtain fixture, G. W. MacKenzie 507,146
Curtain fixture, R. Malin 507,443
Curtain or blind support, J. Fraley 507,265
Curtain, window ventilating, W. Amos 507,590
Cut-out, L. W. Miller 507,150
Cutter. See Glass cutter. Meat cutter.
Die. See Trimming die.
Dish drainer, E. C. Marshall 507,223
Door, combined screen and storm, C. R. Moore 507,151
Door operating apparatus, electric, Hicks & Troy 507,269
Dough mixing machine, G. W. Greig 507,360
Draught equalizer, O. S. Ellithorp 507,113
Draught hook, F. Giles 507,429
Dry closet, S. L. Bailey 507,202
Dust collector, W. H. Hankinson 507,319
Edging for fabrics and forming same, J. M. Merrow 507,225
Edging or border, J. M. Merrow 507,590
Electric heater, C. L. Coombs 507,217
Electric motor, reciprocating, H. Pieper, Fils 507,449
Electric selecting device, S. S. Bozart 507,205, 507,206
Electric wires, distributing frame for, Ford & Lenfest 507,494
Electrical currents, apparatus for controlling the application of, R. Lundell 507,144
Electrical distribution, system of, Stanley, Jr., Kelly 507,391
Electrode, F. M. Lyte 507,374
Elevator. See Ore elevator. Water elevator.
Elevator guide sheave, N. P. Otis 507,157
Emery wheel and support, C. L. Hyde 507,223
Engine. See Expansion engine. Gas engine. Hydraulic engine. Locomotive engine. Quadruplex engine. Rotary steam engine. Steam engine.
Engines, electrical ignitor for gas or hydrocarbon, P. A. N. Winand 507,515, 507,516
Expansion engine, multiple, C. C. Worthington 507,196
Extension table, E. F. Baum 507,401
Extractor. See Stump extractor.
Eyeglasses, C. M. Haynes 507,454
Fan, J. Arthur 507,283
Fan or blowing apparatus, P. Mortier 507,445
Fence strands, implement for tightening wire, E. G. Rogers 507,454
Fencing, making barbed, T. V. Allis 507,198
Fencing, making barbed, E. Jordan 507,227
Fencing, making barbed, J. H. Templin, 507,182 to 507,186
Fencing, making metallic, T. V. Allis 507,197
Fender. See Car safety fender.
Fibers, manufacture of colored tops or slivers from combed animal, E. Maertens 507,232
Fibers, softening vegetable, Jones & Warr, 507,225, 507,501
Fifth wheel, M. J. Delaney 507,433
File holder, J. C. Keefe 507,228
Filtering and sterilizing apparatus, J. H. Eickenhoff 507,384
Fire and stable alarm and horse releaser, electric, A. R. Holmes 507,332
Firearm sight, E. G. Latta 507,278
Fire escape, C. E. Sansoucy 507,455
Fireplace, W. Spinner 507,300
Flue cleaner, boiler, C. S. Dean 507,471
Flushing tank for closets, J. Michel *et al* 507,149
Freight carrier, A. T. Kelliher 507,137

Fuel blocks, manufacture of, G. Spiecker ... 507,246
Furnace. See Metallurgical furnace.
Furnace, A. Anderson ... 507,096
Gauge. See Pressure gauge.
Game apparatus, Z. K. Bates ... 507,098
Game apparatus, J. Huebner ... 507,328
Gas engine, Hirsch & Schilling ... 507,436
Gas, manufacturing, M. P. Goff ... 507,491
Gas, manufacturing, H. M. Young ... 507,252
Gas, obtaining hydrogen and carbonic acid, F. Salomon ... 507,331
Gas, process of and apparatus for making and burning fuel, G. Jones ... 507,500
Generator. See Steam generator.
Glass articles, manufacture of hollow, L. Appert ... 507,400
Glass beveling machine, plate, E. Hill ... 507,127
Glass bottles, mould for making, T. W. Synnott ... 507,337
Glass cutter and guide therefor, E. Walsh, Jr ... 507,395
Grain binder reel, H. Benroth ... 507,355
Grain bins, construction of hopper bottom, Macdonald & Metcalf ... 507,324
Grain cleaner and grader, gravity and cut-off, D. J. Davidson ... 507,466
Grater, A. H. Scarles ... 507,297
Gun, repeating air, E. K. Bailey ... 507,470
Hammer, tack, J. Gose ... 507,317
Hammock, G. B. French ... 507,436
Hanger. See Lamp hanger.
Hanger, W. Trewhella ... 507,394
Harp support, mouth, J. Gose ... 507,318
Harrow cleaner, disk, W. A. Daley ... 507,312
Hay loader, E. W. Daily ... 507,199
Hay press, F. P. Fowler ... 507,425
Hay press, A. G. Wilson ... 507,250
Header attachment, J. Garrett ... 507,427
Heater. See Electric heater.
Heater and condenser, Paull & Brown ... 507,395
Heating and welding apparatus, electric, C. L. Coffin ... 507,419
Hinge, adjustable, C. N. Partlow ... 507,242
Hinge butts, structural blank for, E. C. Smith ... 507,396
Hinge, gate, Wackins & Rugg ... 507,191
Hollow articles, method of and apparatus for manufacturing, R. R. Singer ... 507,175
Hook. See Draught hook.
Hoop cutting machine, J. Naylor, Jr ... 507,503
Horse detacher, J. Smaill ... 507,461
Horseshoe, C. C. Jerome ... 507,272
Horseshoe, G. C. Kline ... 507,276
Horseshoe, nailless, R. D'Anvers ... 507,420
Hot water appliance, D. M. Small ... 507,519
Hydraulic engine, double-acting, F. Bernardi ... 507,495
Hygienic purposes, application of electricity to pianos or other keyed instruments for, W. Willeringhaus ... 507,399
Ice cream freezer, W. S. Rolston ... 507,329
Indicator. See Station indicator.
Induction coil adjustable, E. M. Senseney ... 507,456
Insole, G. Gambino ... 507,490
Insulated wire, H. H. Brown ... 507,357
Insulator, trolley wire, M. S. Williams ... 507,399
Iron. See Curling iron. Sad iron.
Ironing board, A. J. Harksen ... 507,221
Joint. See Rail joint.
Key, S. C. Bole ... 507,408
Kiln. See Brick kiln. Limestone burning kiln.
Label holder, F. D. Thomson ... 507,393
Labeling machine, H. H. Leister ... 507,372
Lampblack machine, G. L. Eater ... 507,220
Lamp hanger, electric, G. P. Hiler ... 507,364
Lamps, hanger board for electric arc, J. J. Wood ... 507,343
Latch and support, gate, L. D. Latimer ... 507,231
Latch, gate, Noll & Corcoran ... 507,155
Lathe, turning, W. Von Pittler ... 507,293
Lawn rake, W. W. Carlisle ... 507,484
Leather dressing machine, W. Evans ... 507,314
Leather, making artificial, J. Chase ... 507,213
Life boat, J. A. Aniello ... 507,096
Limb, artificial, J. F. Read ... 507,453
Lime kiln, cupola, or metallurgical furnace, E. J. Bird ... 507,204
Limestone burning kiln, J. Briggs ... 507,411
Line holder, J. R. Chamblin ... 507,418
Liquid dispensing apparatus, W. M. Fowler ... 507,316
Lock, Tracy & Noble ... 507,188
Locomotive, electric, J. T. Wilson ... 507,306
Locomotive engine, compound, F. W. Dean ... 507,263
Loom, R. Rigby ... 507,338
Loom shedding mechanism, T. C. Orndorff ... 507,240
Lubricator, G. W. Boyd ... 507,409
Lubricator, S. F. Woodworth ... 507,307
Machine feed mechanism, Hauck & Comstock ... 507,496
Mail box, P. H. Beenck ... 507,474
Map holder, H. Smith ... 507,178
Match bunching machine, C. S. Andrews ... 507,389
Matrix board, Carr & French ... 507,485
Measure and funnel, combined, J. H. Bradneck ... 507,479
Measuring device for box covering machines, A. G. Potter ... 507,451
Measuring machine, cloth, J. E. Windle ... 507,309
Meat cutter, O. D. Woodruff ... 507,105
Mechanical apparatus, device for selecting and operating, R. Mackie ... 507,147
Mechanical devices, apparatus for selecting and operating, R. Mackie ... 507,148
Mechanical movement, C. Lloyd ... 507,142
Metallic roller, F. G. & A. C. Sargent ... 507,328
Metallurgical furnace, G. F. Simonds ... 507,490
Metals, electrolytic production of, C. Hoepfner ... 507,130
Mill. See Pulverizing mill.
Mirror mase, G. V. Palm ... 507,150
Mould. See Type mould.
Mould, mould facing, and core and making same, B. Jones ... 507,226
Mortar, druggist's and chemist's, F. L. Brashear ... 507,410
Motor. See Electric motor. Water motor.
Motor, B. L. Pickard ... 507,327
Motor, N. L. Turner ... 507,464
Nail machines, die for wire, R. Naysmith ... 507,379
Net, fly, C. E. Rhinehart ... 507,285
Nut locks, making, W. E. Spooner ... 507,291
Nut, wagon, W. H. & B. H. Collins ... 507,310
Oil, process of and apparatus for deodorizing and refining crude, S. H. Laird ... 507,230
Ore elevator, L. J. Hewes ... 507,126
Ore leaching apparatus, W. D. Bohm ... 507,260
Ore washer and concentrator, C. F. Pike (r) ... 11,377
Oven, W. Dalton ... 507,110
Paper clamp, W. C. Bowry ... 507,478
Paper feeding machine, T. A. Briggs ... 507,308
Pen, stylographic, D. W. Beaumel ... 507,368
Pencil sharpener, H. W. Hopkins ... 507,427
Petroleum, refining, H. Koehler ... 507,441
Pins or brooches, stock for hinge joints of, B. A. Ballou ... 507,254
Pipe. See Tobacco pipe.
Pipe trap cleaner, waste, E. Helfenstelier, Jr ... 507,435
Pipes, detachable jacket for steam, W. A. Macon ... 507,146
Plane guide, J. McKnight ... 507,378
Planter, potato, A. G. Gekeler ... 507,428
Plow, W. T. Hogg ... 507,271
Plow, J. L. Pearson ... 507,282
Plow, W. M. Taylor ... 507,509
Plow attachment, G. I. Bjorneby ... 507,475
Pocketbooks, etc., frame for, A. W. Scheuber ... 507,485
Portable boat, C. W. King ... 507,439
Powder. See Smokeless powder.
Press. See Hay press. Printing press. Printing plate bending press.
Pressure brake, fluid, A. H. Moyes ... 507,447
Pressure gauge, H. Rauecz et al. ... 507,287
Printing plate bending press, A. Gray ... 507,431
Printing press, C. A. Corbitt ... 507,496
Printing press numbering attachment, W. B. Carr ... 507,416
Propeller, L. D. B. Shaw ... 507,450
Propeller, screw, H. C. Happold ... 507,320
Propeller, screw, J. D. Muller ... 507,502
Protractor, B. H. Colby ... 507,216
Puller. See Skewer puller.
Pulleys, facing, C. T. J. Vautin ... 507,467
Pulverizing mill, E. C. Griffin ... 507,432
Pump controlling device, automatic, Burrows & Clark ... 507,211
Puzzle, W. Churchill ... 507,215
Puzzle card case, A. F. Smith ... 507,244
Quadruplex engine, E. W. Harden ... 507,433
Rail joint, M. C. Niles ... 507,282
Railway alarm, A. T. Roberts ... 507,288
Railway, closed conduit electric, H. Weir ... 507,389
Railway conduit, electric, G. F. Green ... 507,498
Railway signal, electric, A. B. Herrick ... 507,126
Railway slot brake, conduit, W. M. Hood ... 507,366
Railway switch, automatic safety, H. C. O. Grubike ... 507,406
Railway system, L. Beecher ... 507,402
Railway tie, C. E. Steiner ... 507,179
Railway time and block signal, A. H. Thorp ... 507,530
Railway time signal, A. C. Gordon ... 507,428
Railway train protector, L. E. C. J. Beerstecher ... 507,209
Railway trains, electric alarm signal for, J. M. Rupel ... 507,130
Rake. See Lawn rake.
Register. See Cash register.
Rein and tail holder, driving, B. Blake ... 507,476
Rendering tank, E. Holthaus ... 507,222
Renovator, C. Karlson ... 507,260
Resistance coil, J. J. Wood ... 507,346
Riveting machine, C. H. Norton ... 507,320
Roller. See Metallic roller.
Rolling mills, automatic feeding device for, J. Roberison ... 507,165
Rotary steam engine, J. Hill ... 507,126
Rubbing machine, C. S. Yarnell ... 507,251
Rubbing or polishing machine, S. F. Moore ... 507,380
Sad iron, H. W. Fibbals ... 507,393
Sandpaper wheel or roller, F. M. Stebbe ... 507,303
Saw jointer, E. B. Pike ... 507,386
Saw set, C. Morrill ... 507,152
Scale, spring, G. H. Chatillon ... 507,107
Screen. See Window screen.
Screen holder, W. Wuestefeld ... 507,389
Screw machine, C. Grotz ... 507,494
Seat. See Window seat.
Secondary battery, C. A. Smyth ... 507,403
Self-closing and self-locking switch, Tracy & Noble ... 507,187
Sewing machine, J. Schaack ... 507,243
Sewing machine, fair-stitch, E. F. Mower ... 507,377
Sewing machine guide, J. Douglas ... 507,112
Sewing machine guiding device, J. Douglas ... 507,489
Sewing machine, shoe, F. J. Freese ... 507,267
Sewing machine shuttle and shuttle-actuating mechanism, D. Williamson ... 507,192
Sewing machine, welt guide, J. G. Greene ... 507,119
Sewing on buttons, machine for, String & Miller ... 507,507
Shade guide strip, window, F. C. Schroeder ... 507,298
Shade hanger bracket, J. E. Knapp ... 507,440
Sheet metal can, E. Barrath ... 507,306 to 507,307
Shoe, J. H. Mulligan ... 507,154
Shoe fastening, G. A. Weld ... 507,249
Signal. See Railway signal. Railway time signal. Railway time and block signal.
Signals, electric apparatus for controlling, M. B. Leonard ... 507,518
Skewer puller, G. P. Pilling ... 507,450
Sled, coasting, A. R. Ayres ... 507,200
Slicer, potato, H. B. O'Connell ... 507,383
Smokeless powder, M. E. Leonard ... 507,279
Spring. See Vehicle spring.
Stamp vending machine, W. H. Kaltenbeck ... 507,369
Stand. See Washstand.
Station indicator, J. Rodrigues ... 507,168
Steam engine, J. S. Sherman ... 507,173
Steam engine, C. White ... 507,468
Steam generator, E. E. Roberts ... 507,504, 507,505
Steam generator, R. G. Ruffles ... 507,169
Steam trap, thermostatic, E. E. Gold ... 507,268
Steering apparatus, hydraulic, C. S. Irwin ... 507,135
Stone breaker or crusher, Gates & Hewes ... 507,118
Stone sawing machine, G. E. Fossick ... 507,357
Storage battery, C. W. Kennedy ... 507,139
Stove, A. W. Alger ... 507,093
Stove, E. J. Daschbach ... 507,219
Stove or range grate, C. H. Resor ... 507,284
Stovepipe attachment, G. C. Allen ... 507,094
Street sweeper, T. W. Downs ... 507,354
Street sweeper, C. Gurney ... 507,361
Stump extractor, P. Hansen ... 507,121
(Surgical.) Appliance for spinal complaints, P. B. Sheldon ... 507,172
Switch. See Automatic switch. Railway switch. Self-closing and self-locking switch.
Switch clearing, salting, and operating device, C. H. Cropsey ... 507,261
Switch frog, safety hinge, J. E. Dunlevy ... 507,423
Switch stand, W. W. Snow ... 507,345
Table. See Extension table.
Tally board, croquet, Mortensen & Larsen ... 507,444
Tally board for roquet, game, A. T. Dana ... 507,111
Tank. See Flushing tank. Rendering tank.
Thrashing machine band cutting and feeding attachment, L. & W. Quintus ... 507,163
Thrashing machine self-feeder, J. Juel ... 507,438
Tire, pneumatic, A. P. Morrow ... 507,325
Tires, inflating device for pneumatic, H. H. Johnson ... 507,224
Tobacco pipe, T. C. Orndorff ... 507,241
Tongue support, vehicle, J. Johnson ... 507,136
Tongues, etc., blank for vehicle, R. R. Singer ... 507,176
Toy figure, C. J. Simonot ... 507,174
Toy or ornamental bird or winged animal, G. H. Newton ... 507,381
Trace carrier, Randall & Chase ... 507,164
Trap. See Animal trap. Steam trap.
Trap, W. J. Vierck ... 507,190
Trimming die, Coleman & Tenney ... 507,300
Trolley wire cleaner, C. H. Thompson ... 507,247
Truck, hand, E. Cardarelli ... 507,106, 507,483
Truck, motor, J. A. Brill ... 507,207, 507,208
Twine making machine, F. G. Becker ... 507,100
Type matrix, W. Kemp, Jr ... 507,275
Type mould, F. H. Bultman ... 507,258
Typewriter manifolding device, H. H. Uns ... 507,189
Umbrella support, N. D. Brooks ... 507,481
Valve, air, A. T. Neilson ... 507,380
Valve for air brakes, triple, H. L. Howe, 507,132, 507,133, 507,498
Valve for fluid pressure brakes, triple, H. L. Howe ... 507,134
Vehicle brake, C. K. Brandenburg ... 507,480
Vehicle, side hill, C. Koenig ... 507,370
Vehicle spring, Hipple & Wolf ... 507,129
Velocipede, T. Beaumont ... 507,413
Velocipede, Fane & Lavender ... 507,114
Velocipede saddle, T. Broadbent ... 507,412
Velocipede saddle, E. Warwick ... 507,304
Vessel or boat, roller, E. Bazin ... 507,099
Wagon, F. E. Havens ... 507,123
Wagon body or rack, W. P. Dunlap ... 507,262
Wagon brake, J. H. Osley ... 507,158
Wagon, dumping, G. W. Harrington ... 507,122
Washer. See Bottle washer. Ore washer.
Washer cutting machine, A. Buchholz ... 507,210
Washstand, Phinney & Whitney ... 507,448
Water closet, H. A. Jukes ... 507,273
Water elevator, steam vacuum, Satteikau & Winkelmann ... 507,335
Water elevator, steam vaccum, H. R. Winkelmann ... 507,342
Water elevator, steam vacuum, Winkelmann & Satteikau ... 507,340
Water elevator, vacuum, P. Satteikau ... 507,334
Water elevators, reserve tank for, H. R. Winkelmann ... 507,341
Water motor, T. J. Vance ... 507,204
Water power, device for utilizing, T. A. Macdonald ... 507,375
Waterproof suit, O. Van Oostrum ... 507,405
Welding apparatus, pipe, J. Simpson ... 507,389
Wheel. See Buffing or polishing wheel. Car wheel. Emery wheel. Fifth wheel. Sandpaper wheel.
Wheel, C. W. Smart ... 507,390
Window screen, J. A. Haviland ... 507,363
Window seat, adjustable, W. Kruppenbacher ... 507,371
Wire cutting machine, W. H. Boggs ... 507,101
Wire stretcher, W. Q. Prewitt ... 507,452
Wood cutting machine, W. F. Hutchinson ... 507,499
Wood, etc., finishing the surface of, V. Victorson ... 507,512
Wool drying apparatus, J. E. Barney ... 507,304
Wool washing machine, F. G. Sargent ... 507,293
Wrench, S. C. Bole ... 507,407

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Brougham body, F. P. Stone ... 22,855
Lantern, G. C. Dressel ... 22,854
Monument, W. H. Perry ... 22,856
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Cigars, Berninger Bros ... 23,741
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Hair preparation, M. S. Kelso ... 23,747
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Ingots or other castings of bronze, Manganese Bronze and Brass Company ... 23,731
Jewelry, spoons, forks, ladles, cutlery, and similar articles, F. N. Osborne ... 23,729, 23,730
Lard, J. M. Ceballos & Company ... 23,738
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Oil and its extract and medicinal and sanitary compounds having these constituents, eucalyptus, Tasmania Eucalyptus Oil Company ... 23,751
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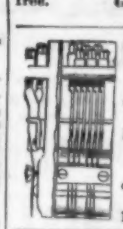

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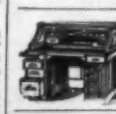

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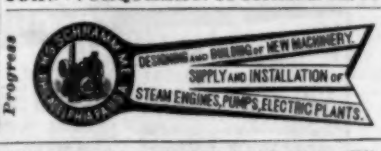

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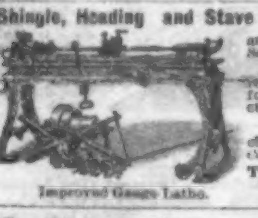

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